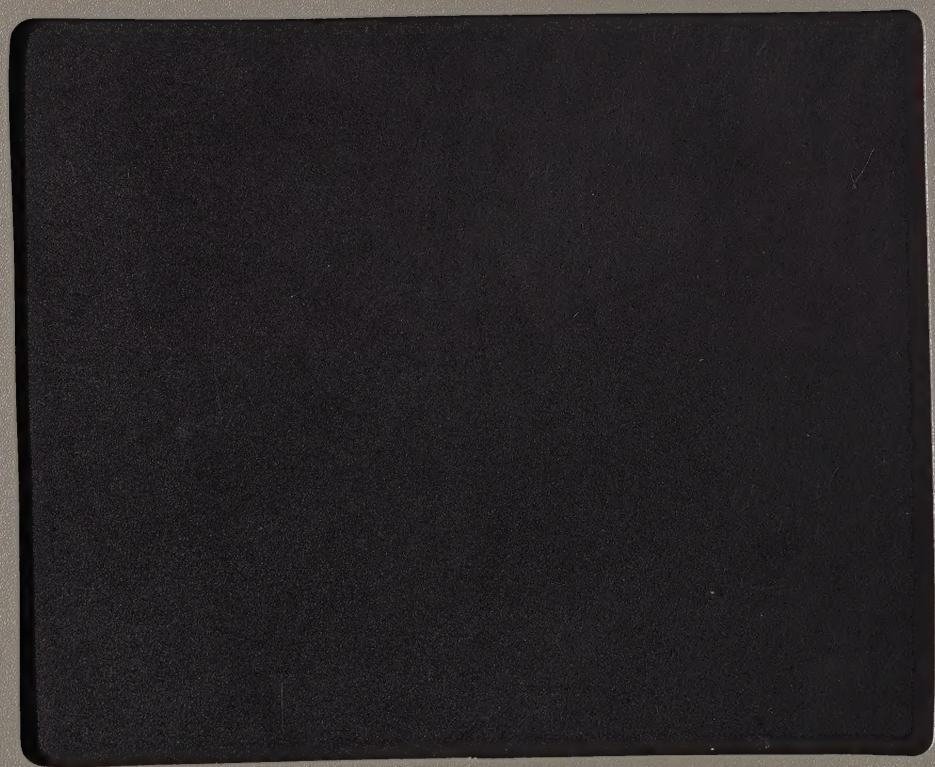


Electronic Services - Los Angeles  
M12542X

GENERAL ELECTRIC  
INSTRUMENTATION SERVICE  
(602) 278-8515  
CAL.  
DUE 9/22  
I.O.



FLUKE®



#### NOTE

This manual documents the Model 8520A and its assemblies at the revision levels shown in Appendix 7A. If your instrument contains assemblies with different revision letters, it will be necessary for you to either update or backdate this manual. Refer to the supplemental change/errata sheet for newer assemblies, or to the backdating sheet in Appendix 7A for older assemblies.

# 8520A

## Digital Multimeter

### Service Manual

P/N 541987  
September 1980



# WARRANTY

Notwithstanding any provision of any agreement the following warranty is exclusive:

The JOHN FLUKE MFG. CO., INC., warrants each instrument it manufactures to be free from defects in material and workmanship under normal use and service for the period of 1-year from date of purchase. This warranty extends only to the original purchaser. This warranty shall not apply to fuses, disposable batteries (rechargeable type batteries are warranted for 90-days), or any product or parts which have been subject to misuse, neglect, accident, or abnormal conditions of operations.

In the event of failure of a product covered by this warranty, John Fluke Mfg. Co., Inc., will repair and calibrate an instrument returned to an authorized Service Facility within 1 year of the original purchase; provided the warrantor's examination discloses to its satisfaction that the product was defective. The warrantor may, at its option, replace the product in lieu of repair. With regard to any instrument returned within 1 year of the original purchase, said repairs or replacement will be made without charge. If the failure has been caused by misuse, neglect, accident, or abnormal conditions of operations, repairs will be billed at a nominal cost. In such case, an estimate will be submitted before work is started, if requested.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS, OR ADEQUACY FOR ANY PARTICULAR PURPOSE OR USE. JOHN FLUKE MFG. CO., INC., SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT, TORT, OR OTHERWISE.

**If any failure occurs, the following steps should be taken:**

1. Notify the JOHN FLUKE MFG. CO., INC., or nearest Service facility, giving full details of the difficulty, and include the model number, type number, and serial number. On receipt of this information, service data, or shipping instructions will be forwarded to you.
2. On receipt of the shipping instructions, forward the instrument, transportation prepaid. Repairs will be made at the Service Facility and the instrument returned, transportation prepaid.

## **SHIPPING TO MANUFACTURER FOR REPAIR OR ADJUSTMENT**

All shipments of JOHN FLUKE MFG. CO., INC., instruments should be made via United Parcel Service or "Best Way"® prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid and of adequate size. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

## **CLAIM FOR DAMAGE IN SHIPMENT TO ORIGINAL PURCHASER**

The instrument should be thoroughly inspected immediately upon original delivery to purchaser. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument is damaged in any way, a claim should be filed with the carrier immediately. (To obtain a quotation to repair shipment damage, contact the nearest Fluke Technical Center.) Final claim and negotiations with the carrier must be completed by the customer.

The JOHN FLUKE MFG. CO., INC., will be happy to answer all applications or use questions, which will enhance your use of this instrument. Please address your requests or correspondence to: JOHN FLUKE MFG. CO., INC., P.O. BOX C9090, EVERETT, WASHINGTON 98206, ATTN: Sales Dept. For European Customers: Fluke (Holland) B.V., P.O. Box 5053, 5004 EB, Tilburg, The Netherlands.

\*For European customers, Air Freight prepaid.

**John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, Washington 98206**

# Table of Contents

| SECTION  | TITLE                                         | PAGE       |
|----------|-----------------------------------------------|------------|
| <b>1</b> | <b>INTRODUCTION AND SPECIFICATIONS .....</b>  | <b>1-1</b> |
| 1-1.     | THE 8520A INSTRUCTION MANUAL SET .....        | 1-1        |
| 1-4.     | LIST OF RECOMMENDED TEST EQUIPMENT .....      | 1-1        |
| 1-6.     | SPECIFICATIONS .....                          | 1-2        |
| <b>2</b> | <b>SHIPPING AND SERVICE INFORMATION .....</b> | <b>2-1</b> |
| 2-1.     | SHIPPING INFORMATION .....                    | 2-1        |
| 2-4.     | SERVICE INFORMATION .....                     | 2-1        |
| 2-7.     | QUESTIONS/PROBLEMS .....                      | 2-1        |
| <b>3</b> | <b>THEORY OF OPERATION .....</b>              | <b>3-1</b> |
| 3-1.     | INTRODUCTION .....                            | 3-1        |
| 3-5.     | FUNCTIONAL BLOCK DIAGRAM DESCRIPTION .....    | 3-1        |
| 3-7.     | DC Volts .....                                | 3-1        |
| 3-9.     | AC and DC + DC Volts .....                    | 3-5        |
| 3-11.    | Ohms and Nanosiemens .....                    | 3-5        |
| 3-13.    | External Reference .....                      | 3-5        |
| 3-15.    | External Trigger Inputs .....                 | 3-5        |
| 3-17.    | Digital Data Flow .....                       | 3-5        |
| 3-19.    | DETAILED DESCRIPTION .....                    | 3-5        |
| 3-21.    | Power Supply (8520A-1023) .....               | 3-5        |
| 3-25.    | Display Assembly (8520A-1011) .....           | 3-10       |
| 3-29.    | Digital Assembly .....                        | 3-10       |
| 3-64.    | Analog Assembly .....                         | 3-11       |
| <b>4</b> | <b>INSTRUMENT ASSEMBLY/DISASSEMBLY .....</b>  | <b>4-1</b> |
| 4-1.     | INTRODUCTION .....                            | 4-1        |
| 4-3.     | TOP/BOTTOM COVER .....                        | 4-1        |
| 4-5.     | Top Analog Guard Covers .....                 | 4-1        |
| 4-7.     | INTERNAL GUARD COVERS .....                   | 4-1        |
| 4-9.     | DC Buffer Guard .....                         | 4-1        |
| 4-10.    | AC Converter Guard .....                      | 4-1        |
| 4-11.    | FRONT PANEL DISPLAY ASSEMBLY .....            | 4-1        |
| 4-13.    | ANALOG ASSEMBLY .....                         | 4-2        |
| 4-15.    | TRANSFORMER AND TRANSFORMER ASSEMBLY .....    | 4-2        |
| 4-17.    | DIGITAL ASSEMBLY .....                        | 4-2        |
| 4-19.    | BOTTOM ANALOG SHIELD .....                    | 4-3        |

TABLE OF CONTENTS, *continued*

| SECTION | TITLE                           | PAGE |
|---------|---------------------------------|------|
| 5       | TROUBLESHOOTING .....           | 5-1  |
| 5-1.    | INTRODUCTION .....              | 5-1  |
| 5-4.    | POWER ON PROCEDURE .....        | 5-1  |
| 5-8.    | SPECIAL PROCEDURES .....        | 5-1  |
| 5-10.   | Analog Controller Test .....    | 5-1  |
| 5-22.   | A/D Converter Test .....        | 5-3  |
| 6       | LIST OF REPLACEABLE PARTS ..... | 6-1  |
|         | TABLE OF CONTENTS .....         | 6-1  |
| 6-1.    | INTRODUCTION .....              | 6-1  |
| 6-4.    | HOW TO OBTAIN PARTS .....       | 6-2  |
| 7       | GENERAL INFORMATION .....       | 7-1  |
| 7A      | MANUAL CHANGE INFORMATION ..... | 7A-1 |
| 8       | SCHEMATIC DIAGRAMS .....        | 8-1  |
|         | TABLE OF CONTENTS .....         | 8-1  |

# List of Tables

| TABLE | TITLE                                               | PAGE |
|-------|-----------------------------------------------------|------|
| 1-1.  | Test Equipment .....                                | 1-2  |
| 1-2.  | 8520A Specifications .....                          | 1-3  |
| 3-1.  | Component Identification .....                      | 3-1  |
| 3-2.  | Filter Settings .....                               | 3-12 |
| 5-1.  | Front Panel PCB Troubleshooting .....               | 5-3  |
| 5-2.  | Digital PCB Troubleshooting .....                   | 5-5  |
| 5-3.  | Analog PCB Troubleshooting .....                    | 5-8  |
| 5-4.  | Error Codes .....                                   | 5-9  |
| 5-5.  | Typical Voltages and Waveforms .....                | 5-10 |
| 5-6.  | Keyswitch Test .....                                | 5-11 |
| 5-7.  | Analog Test Failure Patterns .....                  | 5-12 |
| 5-8.  | Analog Controller Latch Outputs .....               | 5-12 |
| 5-9.  | Low Ohms Test .....                                 | 5-19 |
| 5-10. | Analog Controller Latch Tests .....                 | 5-19 |
| 5-11. | Analog Controller UART Test .....                   | 5-20 |
| 5-12. | Analog Controller Interrupt Test .....              | 5-20 |
| 5-13. | UART and Interrupt Troubleshooting Procedures ..... | 5-21 |

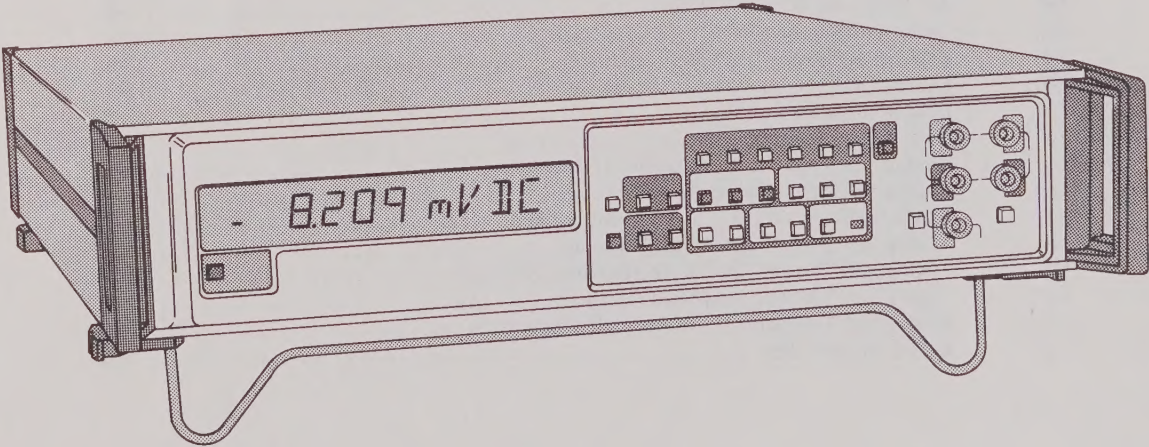


Digitized by the Internet Archive  
in 2026

[https://archive.org/details/manualsplus\\_11650](https://archive.org/details/manualsplus_11650)

## List of Illustrations

| FIGURE       | TITLE                                                       | PAGE |
|--------------|-------------------------------------------------------------|------|
| Frontispiece | 8520A Digital Multimeter .....                              | iv   |
| 1-1.         | 8520A Instruction Manual Set .....                          | 1-2  |
| 1-2.         | Outline Drawing .....                                       | 1-7  |
| 3-1.         | Assembly Placement .....                                    | 3-2  |
| 3-2.         | 8520A Block Diagram .....                                   | 3-3  |
| 3-3.         | DC Volts .....                                              | 3-4  |
| 3-4.         | AC Volts and AC + DC Volts .....                            | 3-6  |
| 3-5.         | Ohms and Nanosiemens .....                                  | 3-7  |
| 3-6.         | External Reference DC Volts .....                           | 3-8  |
| 3-7.         | External Trigger Inputs .....                               | 3-9  |
| 3-8.         | Low Ohms Measurements .....                                 | 3-13 |
| 3-9.         | High Ohms Measurements .....                                | 3-13 |
| 5-1.         | Analog Self Tests #1, 2, 3 Simplified Schematic .....       | 5-13 |
| 5-2.         | Analog Self Test #4 Simplified Schematic .....              | 5-13 |
| 5-3.         | Analog Self Tests #5, 6, 7 Simplified Schematic .....       | 5-14 |
| 5-4.         | Analog Self Test #8 Simplified Schematic .....              | 5-15 |
| 5-5.         | Analog Self Tests #9, 10, 11, 12 Simplified Schematic ..... | 5-16 |
| 5-6.         | Analog Self Test #13 Simplified Schematic .....             | 5-17 |
| 5-7.         | Analog Self Tests #14, 15, 16 Simplified Schematic .....    | 5-18 |
| 5-8.         | A/D Converter Test .....                                    | 5-22 |



8520A Digital Multimeter

## Section 1

# Introduction and Specifications

### WARNING

**THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.**

#### 1-1. THE 8520A INSTRUCTION MANUAL SET

1-2. The John Fluke Model 8520A Digital Multimeter is documented by a set three manuals: the 8520A Operator Manual, the 8520A Calibration Manual, and the 8520A Service Manual. The 8520A Operator Manual introduces the operator to the 8520A, familiarizes the operator with all instrument controls, connectors, and indicators, and presents detailed local and remote operating information and procedures. The 8520A Calibration Manual provides general maintenance procedures, Performance Tests, and Calibration Adjustment procedures. The 8520A Service Manual contains the theory of operation, troubleshooting information, a list of replaceable parts, and schematics. As Figure 1-1 shows, the three manuals can either be separated for use in different areas or joined together in a single binder.

1-3. The information in this, the 8520A Service Manual, is divided into eight sections:

- 1 INTRODUCTION AND SPECIFICATIONS  
Introduces the 8520A Instruction Manual Set, lists the recommended test equipment necessary to complete the Performance Tests and Calibration Adjustments, and lists the instrument specifications.
- 2 SHIPPING AND SERVICE INFORMATION  
If there is a problem with your 8520A, this section describes how to get it corrected and how to ship the instrument.

#### 3 THEORY OF OPERATION

Describes in detailed block diagrams the operation of the instrument at the block diagram level.

#### 4 INSTRUMENT ASSEMBLY/DISASSEMBLY

Describes how to disassemble and reassemble the instrument.

#### 5 TROUBLESHOOTING

A procedure to isolate faults in the instrument to a circuit or component level.

#### 6 LIST OF REPLACEABLE PARTS

An illustrated list of components contained in the instrument. Includes the reference number, nomenclature, Fluke and Manufactures Part number, Manufactures Code and Quantity.

#### 7 GENERAL INFORMATION AND MANUAL CHANGE INFORMATION

Information allowing the reader to backdate the manual to any previous revision level.

#### 8 SCHEMATICS

Schematic diagrams of the electronic circuits in the instrument.

#### 1-4. LIST OF RECOMMENDED TEST EQUIPMENT

1-5. Table 1-1 lists the test equipment required to complete the Adjustment Procedures described in this manual. Equivalent instruments can be substituted if the

recommended models are not available. The Calibration Adjustment procedure is called out as part of the Troubleshooting procedure. The DMM and Oscilloscope are also required for fault isolation; however, in some

cases a logic probe, e.g., the Tektronix P6401, may be substituted for the Oscilloscope.

1-6. SPECIFICATIONS

1-7. Table 1-2 lists the 8520A specifications.

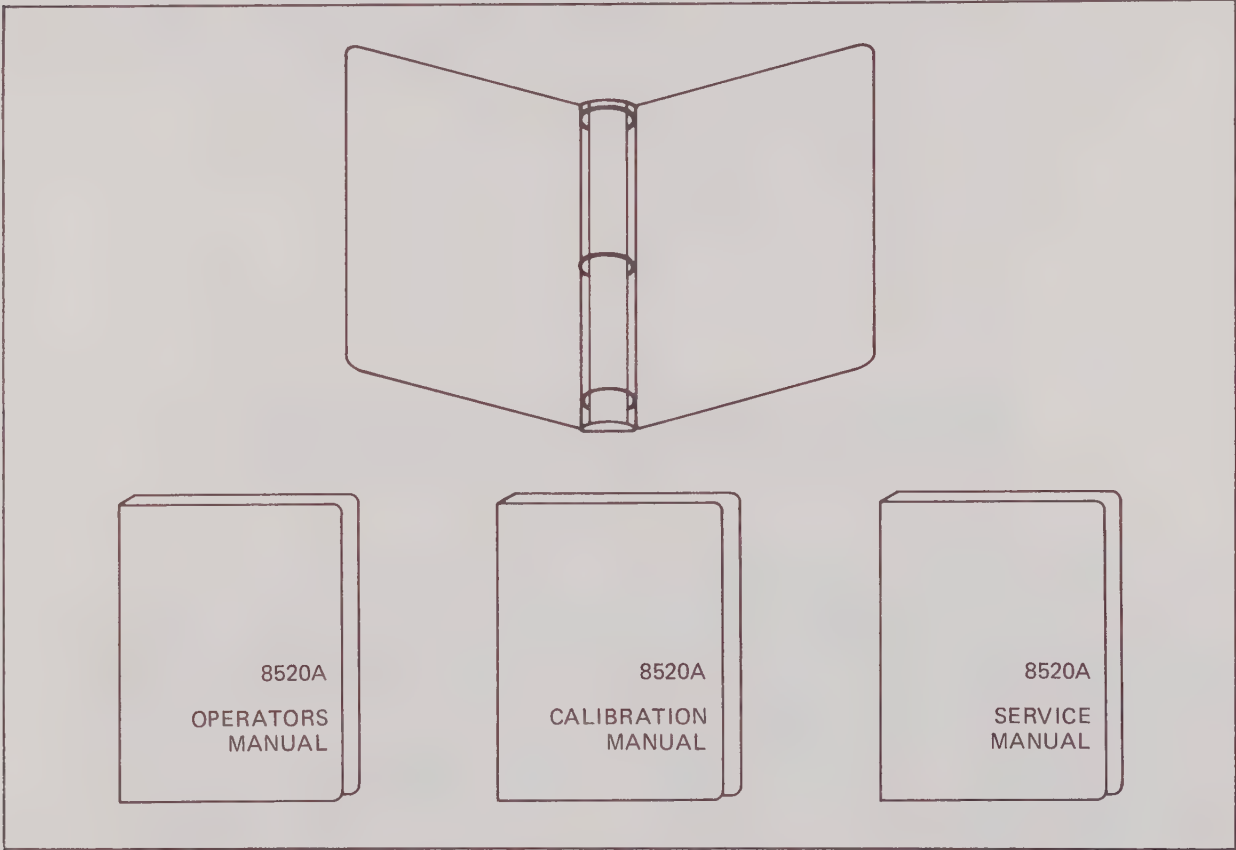


Figure 1-1. 8520A Instruction Manual Set

Table 1-1. Test Equipment

| ITEM                                                                                                                                                   | SPECIFICATIONS<br>(MINIMUM)                                                                                                                                                                                     | NOMENCLATURE                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DMM<br>Oscilloscope<br>DC Voltage Standard<br>Ratio Standard<br><br>AC Calibrator<br>Power Amplifier<br>Standard Resistor<br>w/Accessories<br><br>Load | 5½ digits 0.005% dc accuracy<br>General Purpose<br>0.001% Accuracy<br>0.1 ppm Resolution, 1 ppm Terminal Linearity<br>≥0.03% Accuracy @ 20 kHz<br>≥0.044% Accuracy @ 20 kHz<br><br><br><br><br><br><br>1 MΩ/1μF | FLUKE 8800A<br>TEKTRONIX T900 Series<br>FLUKE 332D or 335D<br>FLUKE 720A<br>FLUKE 5200A<br>FLUKE 5205A or 5215A<br>ESI 1010 100Ω and 10 kΩ,<br>ESI 1050 1 MΩ. ESI SB103<br>shorting bars, ESI PC101<br>Parallel Compensation<br>Network<br>1 MΩ ±1% 1/8 W, mF resistor in parallel<br>with a 1 μF ±20% 10V capacitor |

Table 1-2. 8520A Specifications

**DC VOLTS****Input Characteristics**

| RANGE  | FULL-SCALE | RESOLUTION  | INPUT RESISTANCE         |
|--------|------------|-------------|--------------------------|
| 100 mV | 199.999    | 1 $\mu$ V   | $\geq 10,000$ M $\Omega$ |
| 1V     | 1.99999    | 10 $\mu$ V  | $\geq 10,000$ M $\Omega$ |
| 10V    | 16.0100    | 100 $\mu$ V | $\geq 10,000$ M $\Omega$ |
| 100V   | 130.000    | 1 mV        | 10 M $\Omega$            |
| 1000V  | 1024.00    | 10 mV       | 10 M $\Omega$            |

**Accuracy:**  $\pm$ (% of input + number of digits)

| RANGE  | 24 HOURS<br>23°C $\pm$ 1°C | 90 DAYS<br>18°C to 28°C | 1 YEAR<br>18°C to 28°C | PLUS TEMP.<br>COEFFICIENT<br>PER °C * |
|--------|----------------------------|-------------------------|------------------------|---------------------------------------|
| 100 mV | 0.003 + 5                  | 0.0065 + 6              | 0.011 + 10             | 0.0005 + 0.5                          |
| 1V     | 0.003 + 1                  | 0.006 + 2               | 0.011 + 2              | 0.0005 + 0.15                         |
| 10V    | 0.002 + 1                  | 0.005 + 1               | 0.009 + 1              | 0.0004 + 0.10                         |
| 100V   | 0.003 + 1                  | 0.007 + 2               | 0.012 + 2              | 0.0005 + 0.15                         |
| 1000V  | 0.0035 + 1                 | 0.0065 + 1              | 0.011 + 11             | 0.0005 + 0.10                         |

\*From 22°C to 0°C or 24°C to 50°C, 24 hours specification

From 18°C to 0°C or 28°C to 50°C, 90 day or 1 year specification

**High Speed Accuracy:**  $\pm$ (% of input + least significant bit)\*

| RANGE  | 90 DAYS<br>18°C to 28°C | 1 YEAR<br>18°C to 28°C | PLUS TEMP.<br>COEFFICIENT<br>PER °C |
|--------|-------------------------|------------------------|-------------------------------------|
| 100 mV | 0.01 + 1                | 0.015 + 1              | 0.001 + .1                          |
| 1V     | 0.01 + 1                | 0.015 + 1              | 0.001 + .05                         |
| 10V    | 0.01 + 1                | 0.015 + 1              | 0.001 + .05                         |
| 100V   | 0.01 + 1                | 0.015 + 1              | 0.001 + .05                         |
| 1000V  | 0.01 + 1                | 0.015 + 1              | 0.001 + .05                         |

\*Typical with 60 Hz line, remote operation, 500 readings per second, 2-byte binary output with 14 bits of data.

**Typical Normal Mode Rejection**

| LINE<br>FREQ | FILTER SETTling TIME |       |        |        |         |        |
|--------------|----------------------|-------|--------|--------|---------|--------|
|              | 25 ms                | 50 ms | 100 ms | 200 ms | 500 ms  | 1s     |
| 50 Hz        | 65 dB                | 68 dB | 71 dB  | 80 dB  | *83 dB  | 86 dB  |
| 60 Hz        | 65 dB                | 68 dB | 71 dB  | 85 dB  | *88 dB  | 91 dB  |
| 400 Hz       | 53 dB                | 56 dB | 60 dB  | 120 dB | *123 dB | 126 dB |

\*Guaranteed minimum rejection

**Common Mode Rejection** ..... True 100 dB at 50 Hz and 60 Hz with 1 k $\Omega$  unbalance in either lead.  
Effective CMR is equal to normal mode rejection plus true CMR.

**Maximum Input** .....  $\pm 1000$ V Peak, HI to LO or GUARD to chassis terminals, and  $\pm 200$ V  
Peak, GUARD to LO terminals, for any range.

Table 1-2. 8520A Specifications (cont)

**Maximum Reading Rate**

| OPERATION    | RESOLUTION | LINE           | READING RATE                   |
|--------------|------------|----------------|--------------------------------|
| Local/Remote | 5½ digits  | 50 Hz<br>60 Hz | 200 rdgs/sec<br>240 rdgs/sec   |
| Remote       | 4½ digits  | 50 Hz<br>60 Hz | >500 rdgs/sec<br>>500 rdgs/sec |

Input Current  $\leq 50$  pA for 30 days @ 18° to 28°C**AC VOLTS (TRUE RMS)****Input Characteristics**

| RANGE | FULL-SCALE | RESOLUTION     | INPUT IMPEDANCE                                                   |
|-------|------------|----------------|-------------------------------------------------------------------|
| 1V    | 1.99999    | 4FL10 $\mu$ V  | 1 M $\Omega$ , $\leq 100$ pF at the<br>V/ $\Omega$ INPUT terminal |
| 10V   | 16.0100    | 4FL100 $\mu$ V |                                                                   |
| 100V  | 130.100    | 4FL1 $\mu$ V   |                                                                   |
| 650V  | 650.000    | 4FL10 $\mu$ V  |                                                                   |

**Accuracy:**  $\pm$ (% of input + % of full-scale)\*\*

For 650V range multiply % FS

| FREQUENCY          | 24 HOURS<br>23°C $\pm 1^\circ$ C |              |                 | 90 DAYS<br>23°C to 28°C |              |                 | 1 YEAR<br>18°C to 28°C |              |                 |
|--------------------|----------------------------------|--------------|-----------------|-------------------------|--------------|-----------------|------------------------|--------------|-----------------|
|                    | % of<br>INPUT                    | + % FS<br>AC | + % FS<br>AC+DC | % of<br>INPUT           | + % FS<br>AC | + % FS<br>AC+DC | % of<br>INPUT          | + % FS<br>AC | + % FS<br>AC+DC |
| 10 Hz to 20 Hz*    | 3.0                              | 0.5          | 0.6             | 3.0                     | 0.6          | 0.7             | 3.5                    | 0.6          | 0.7             |
| 20 Hz to 40 Hz*    | 0.4                              | 0.3          | 0.4             | 0.5                     | 0.5          | 0.6             | 0.6                    | 0.6          | 0.7             |
| 40 Hz to 20 kHz    | 0.08                             | 0.02         | 0.06            | 0.1                     | 0.03         | 0.08            | 0.15                   | 0.05         | 0.16            |
| 20 kHz to 100 kHz  | 1.0                              | 0.3          | 0.4             | 1.0                     | 0.3          | 0.4             | 2.0                    | 0.6          | 0.8             |
| 100 kHz to 300 kHz | 2.4                              | 0.6          | 0.6             | 2.4                     | 0.6          | 0.6             | 4.0                    | 1.0          | 1.0             |
| 300 kHz to 1 MHz   | 8.0                              | 2.5          | 2.5             | 8.0                     | 2.5          | 2.5             | 15.0                   | 5.0          | 5.0             |

\*Assumes smoothing using the Statistics Math Program ( $\sim 8$ ).

\*\*From 0.1% of Range to Full Scale

**Temperature Coefficient** ..... 18°C to 0°C or 28°C to 50°C, to 20 kHz.AC MODE .....  $\pm$  (.007% of input + .007% FS)/°CAC + DC MODE .....  $\pm$  (.007% of input + .014% FS)/°C**Maximum Input** .....  $\pm 1000$ V, Peak HI to LO or GUARD to chassis terminals, and  $\pm 200$ V  
Peak GUARD to LO terminals for any range.**Volt-Hertz Product** .....  $\leq 2 \times 10^7$  (slew rate  $\leq 177$ V/ $\mu$ Sec)**Crest Factor** ..... Exceeds 4:1 @ full scale, increasing downscale.**Maximum Reading Rate** ..... 10 rdgs/sec (for  $< 300$  Hz use reading rates of 5, 2, or 1 rdg/sec to  
insure stated accuracy)

Table 1-2. 8520A Specifications (cont)

**OHMS****Input Characteristics**

| RANGE          | FULL-SCALE | RESOLUTION      | CURRENT THRU UNKNOWN | OPEN CURRENT VOLTAGE |
|----------------|------------|-----------------|----------------------|----------------------|
| 10 $\Omega$    | 19.9999    | 100 $\mu\Omega$ | 10 mA                | <8V                  |
| 100 $\Omega$   | 199.999    | 1 m $\Omega$    | 10 mA                |                      |
| 1000 $\Omega$  | 1999.99    | 10 m $\Omega$   | 1.0 mA               |                      |
| 10 k $\Omega$  | 19.9999    | 100 m $\Omega$  | 0.1 mA               |                      |
| 100 k $\Omega$ | 199.999    | 1 $\Omega$      | 14.5 $\mu$ A(max)    |                      |
| 1 M $\Omega$   | 1.99999    | 10 $\Omega$     | 1.5 $\mu$ A(max)     |                      |
| 10 M $\Omega$  | 19.9999    | 1 k $\Omega$    | 1.5 $\mu$ A(max)     |                      |

**Accuracy**  $\pm$ (% of input + number of digits)

| RANGE          | 24 HOURS<br>23°C $\pm$ 1°C | 90 DAYS<br>18°C TO 28°C | 1 YEAR<br>18°C TO 28°C | PLUS TEMP.<br>COEFFICIENT<br>PER °C* |
|----------------|----------------------------|-------------------------|------------------------|--------------------------------------|
| 10 $\Omega$    | 0.0045 + 6                 | 0.0080 + 7              | 0.0140 + 12            | 0.0007 + 0.2                         |
| 100 $\Omega$   | 0.0035 + 2                 | 0.0070 + 2              | 0.0125 + 3             | 0.0007 + 0.2                         |
| 1000 $\Omega$  | 0.0035 + 2                 | 0.0070 + 2              | 0.0125 + 3             | 0.0007 + 0.2                         |
| 10 k $\Omega$  | 0.0035 + 2                 | 0.0070 + 2              | 0.0125 + 3             | 0.0007 + 0.2                         |
| 100 k $\Omega$ | 0.0040 + 2                 | 0.0090 + 2              | 0.0140 + 3             | 0.0012 + 0.2                         |
| 1 M $\Omega$   | 0.0090 + 2                 | 0.0160 + 2              | 0.0200 + 3             | 0.0020 + 0.2                         |
| 10 M $\Omega$  | 0.0300 + 1                 | 0.0440 + 1              | 0.0450 + 3             | 0.0030 + 0.2                         |

\*From 18°C to 0°C or 28°C to 50°C

**Maximum Input** .....  $\pm$ 400V peak for any range.**Maximum Reading Rate:** 10/sec at 100 K $\Omega$  and above.

| OPERATION    | RESOLUTION | LINE  | READING RATE   |
|--------------|------------|-------|----------------|
| Local/Remote | 5½ digits  | 50 Hz | 200 rdgs/sec   |
|              |            | 60 Hz | 240 rdgs/sec   |
| Remote       | 4½ digits  | 50 Hz | >500 rdgs/sec  |
|              |            | 60 Hz | > 500 rdgs/sec |

**CONDUCTANCE****Range** ..... 100 nS**Full Scale** ..... 202.00 nS**Resolution** ..... 0.01 nS**Accuracy:**  $\pm$ (% of input + number of digits)

| 24 HOURS<br>23°C $\pm$ 1°C | 90 DAYS<br>18°C to 28°C | 1 YEAR<br>18°C to 28°C | *PLUS TEMP.<br>COEFFICIENT<br>PER °C |
|----------------------------|-------------------------|------------------------|--------------------------------------|
| 0.04 + 5                   | 0.05 + 5                | 0.06 + 5               | 0.004 + 1                            |

\*From 18°C to 0°C or 28°C to 50°C

**Maximum Input** .....  $\pm$ 400V peak**Maximum Reading Rate** ..... 10 rdgs/sec

Table 1-2. 8520A Specifications (cont)

EXTERNAL REFERENCE

- Operating Range** .....  $\pm 0.5\text{V}$  dc to  $\pm 33\text{V}$  dc as long as external reference is within  $\pm 16.5\text{V}$  of input LO terminal.
- Input Impedance** .....  $10,000\text{ M}\Omega$  between external reference HI or LO terminals and input LO terminals.

Accuracy

| X-REF VOLTAGE | ACCURACY                                           |
|---------------|----------------------------------------------------|
| 16.5 to 33V   | $\pm(A + B + 20\text{ ppm})$                       |
| 0.5V to 16.5V | $\pm A + B + (400\text{ ppm } 1V_{\text{ref } 1})$ |

NOTE: *A* = DC 10 volt range accuracy  
*B* = Input voltage or resistance range accuracy

- Maximum Input** .....  $\pm 180\text{V}$  peak between external reference HI or LO and input LO;  $\pm 360\text{V}$  peak between external reference HI and LO.
- Transfer Accuracy** ..... The following accuracy specifications apply when:  
Filter settling time is 500 or 1000 ms.  
Measurements are made more than 2 hours after warmup.  
Measurements are made within one range.  
Standard is checked at least every hour.  
Ambient temperature stability within  $\pm 1^\circ\text{C}$ .

DC VOLTAGE

| RANGE  | $\pm(\% \text{ OF INPUT} + \text{NUMBER OF DIGITS})$ |
|--------|------------------------------------------------------|
| 100 mV | $0.0020 + 4$                                         |
| 1V     | $0.0020 + 1$                                         |
| 10V    | $0.0010 + 1$                                         |
| 100V   | $0.0020 + 1$                                         |
| 1000V  | $0.0020 + 1$                                         |

AC VOLTAGE (all ranges)

| FREQUENCY         | $\pm(\% \text{ OF INPUT} + \% \text{ OF FULL-SCALE})$ |
|-------------------|-------------------------------------------------------|
| 10 Hz to 20 Hz    | $1.0 + 0.2$                                           |
| 20 Hz to 40 Hz    | $0.1 + 0.1$                                           |
| 40 Hz to 20 kHz   | $0.005 + 0.007$                                       |
| 20 kHz to 100 kHz | $0.100 + 0.030$                                       |
| 100 kHz to 1 MHz  | $0.500 + 0.060$                                       |

AC VOLTAGE, DC COUPLED ..... Same as AC Voltage except 40 Hz – 20 kHz,  $0.005 + 0.010$ .

Resistance

| RANGE          | $\pm(\% \text{ OF INPUT} + \text{NUMBER OF DIGITS})$ |
|----------------|------------------------------------------------------|
| 10 $\Omega$    | $0.0030 + 5$                                         |
| 100 $\Omega$   | $0.0020 + 2$                                         |
| 1000 $\Omega$  | $0.0020 + 2$                                         |
| 10 k $\Omega$  | $0.0020 + 2$                                         |
| 100 k $\Omega$ | $0.0020 + 2$                                         |
| 1 M $\Omega$   | $0.0050 + 2$                                         |
| 10 M $\Omega$  | $0.0100 + 1$                                         |

**Conductance** .....  $\pm(0.02\% \text{ of input} + 0.02\text{ nS})$

**Table 1-2. 8520A Specifications (cont)**

**GENERAL**

|                                      |                                                                            |
|--------------------------------------|----------------------------------------------------------------------------|
| <b>Interface</b> .....               | IEEE-488 - 1978 is standard.                                               |
| <b>Temperature</b> .....             | 0°C to 50°C operating; -25°C to +75°C non-operating.                       |
| <b>Relative Humidity</b> .....       | ≤95% at 25°C, ≤75% at 40°C, ≤45% at 50°C.                                  |
| <b>Shock and Vibration</b> .....     | Meets MIL-T 28800B for type III, Class 5, Style E.                         |
| <b>Power</b> .....                   | 100, 120, 220, or 240V ac, ±10%; 50,60, or 400 Hz ±5%, ≤50W.               |
| <b>Size</b> .....                    | 8.89 cm H/47.00 cm L/43.18 cm W (3½ in H/18½ in L/17 in W) See Figure 1-2. |
| <b>Weight</b> .....                  | 9.56 kg (21 lbs)                                                           |
| <b>Protection Class Code 1</b> ..... | Relates solely to insulation of grounding properties in IEC 348.           |

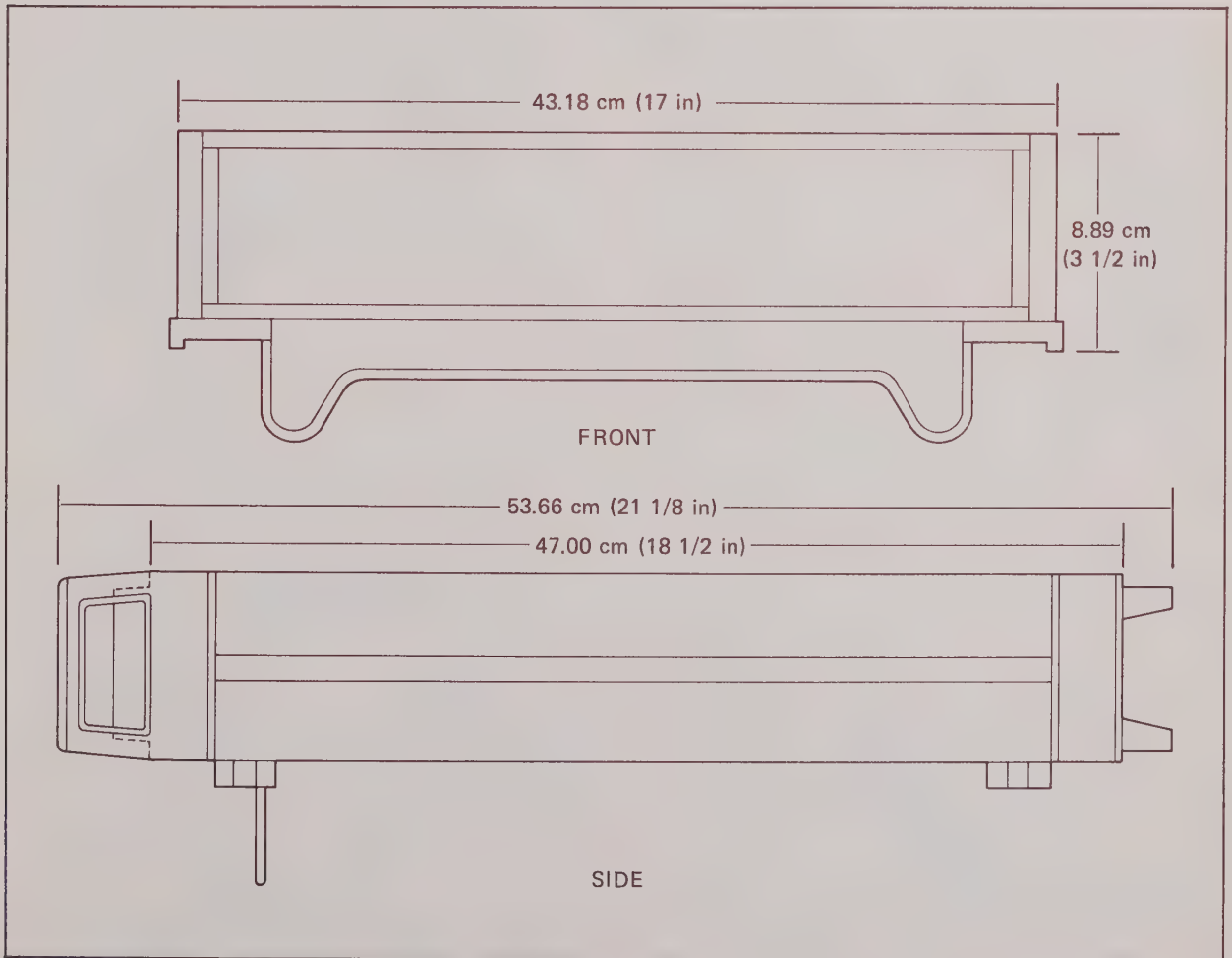


**Figure 1-2. Outline Drawing**

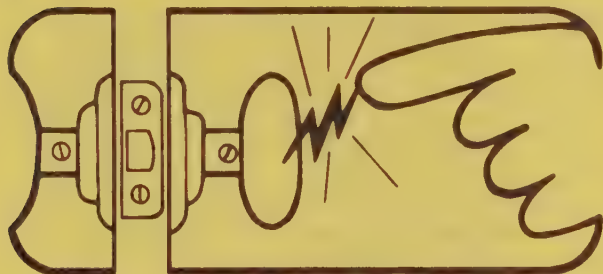




# static awareness



A Message From  
**John Fluke Mfg. Co., Inc.**

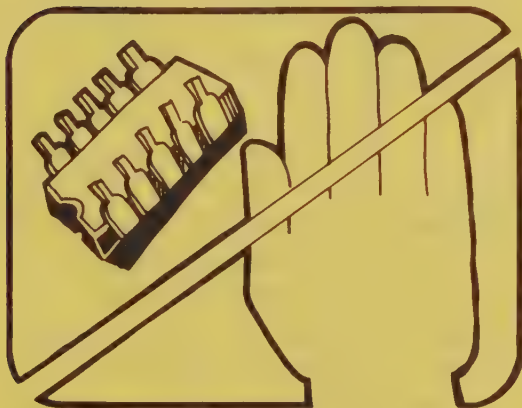


Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol "ⓧ"

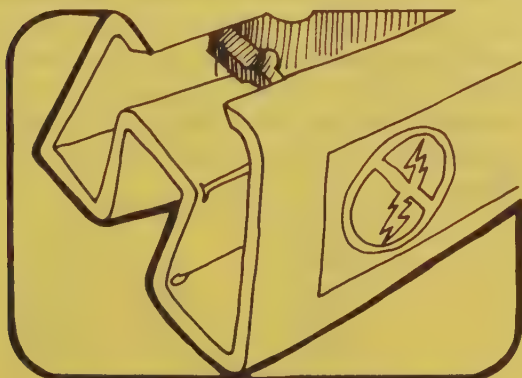
The following practices should be followed to minimize damage to S.S. devices.



1. MINIMIZE HANDLING



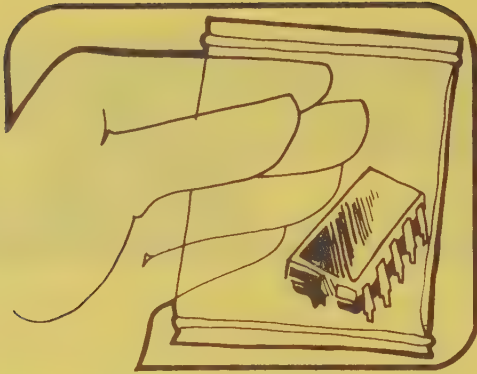
3. DISCHARGE PERSONAL STATIC  
BEFORE HANDLING DEVICES



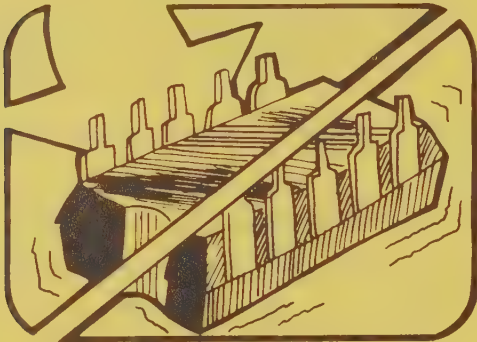
2. KEEP PARTS IN ORIGINAL CONTAINERS  
UNTIL READY FOR USE.



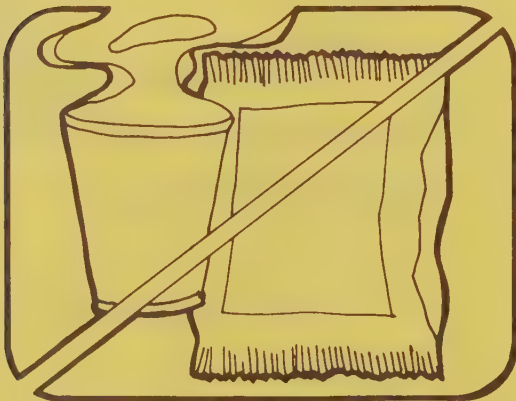
4. HANDLE S.S. DEVICES BY THE BODY



5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT

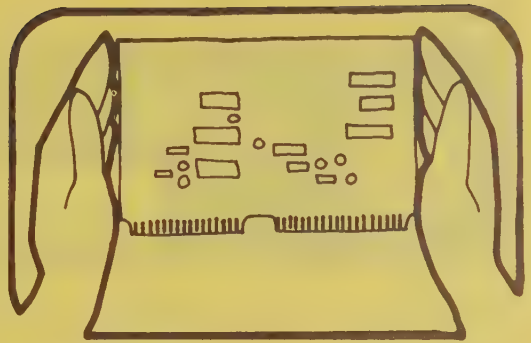


6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE

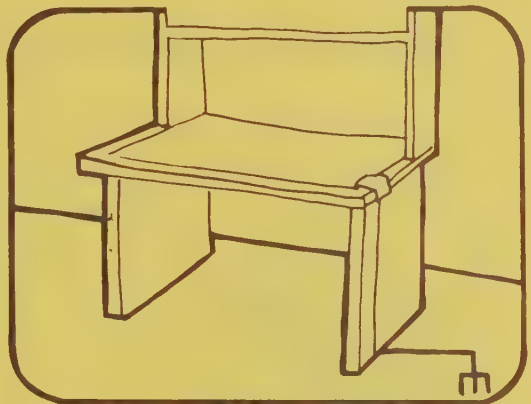


7. AVOID PLASTIC, VINYL AND STYROFOAM® IN WORK AREA

PORTIONS REPRINTED  
WITH PERMISSION FROM TEKTRONIX, INC.  
AND GENERAL DYNAMICS, POMONA DIV.



8. WHEN REMOVING PLUG-IN ASSEMBLIES, HANDLE ONLY BY NON-CONDUCTIVE EDGES AND NEVER TOUCH OPEN EDGE CONNECTOR EXCEPT AT STATIC-FREE WORK STATION. PLACING SHORTING STRIPS ON EDGE CONNECTOR USUALLY PROVIDES COMPLETE PROTECTION TO INSTALLED SS DEVICES.



9. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION  
10. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.  
11. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

Anti-static bags, for storing S.S. devices or pcbs with these devices on them, can be ordered from the John Fluke Mfg. Co., Inc.. See section 5 in any Fluke technical manual for ordering instructions. Use the following part numbers when ordering these special bags.

| John Fluke Part No. | Description   |
|---------------------|---------------|
| 680892              | 5" x 8" Bag   |
| 680934              | 8" x 10" Bag  |
| 680942              | 8" x 12" Bag  |
| 680983              | 12" x 16" Bag |
| 681023              | 18" x 18" Bag |

|                    |             |
|--------------------|-------------|
| Pink Poly Sheet    | Wrist Strap |
| 30" x 60" x 60 Mil | P/N TL6-60  |
| P/N RC-AS-1200     | \$7.00      |
| \$20.00            |             |

## Section 2

# Shipping and Service Information

### 2-1. SHIPPING INFORMATION

2-2. The 8520A is packaged and shipped in a foam-packed container. When you receive the 8520A, inspect the instrument thoroughly for possible shipping damage. Special instructions for inspection and claims are included on the shipping container.

2-3. If reshipment is necessary, use the original container. If the original container is not available, order a new one from John Fluke Mfg. Co., Inc. / P.O. Box C9090 / Everett, Washington 98204, Telephone (206) 342-6300.

### 2-4. SERVICE INFORMATION

2-5. Each John Fluke Model 8520A Digital Multimeter is warranted for a period of one year upon delivery to the

original purchaser. The WARRANTY is located at the front of this manual.

2-6. Factory authorized calibration and service for each Fluke product is available at various worldwide locations. Tables 2-1 and 2-2 provide a complete list of these service centers. If requested, the customer will be provided with an estimate before any work begins on instruments that are beyond the Warranty period.

### 2-7. QUESTIONS/PROBLEMS

2-8. For additional information, contact your nearest John Fluke Sales Representative (Tables 2-3 and 2-4) or the John Fluke Mfg. Co., Inc. at the address or telephone number given above.

Table 2-1. Fluke Technical Service Centers - U.S. and Canada

**UNITED STATES****CA, Burbank**

Fluke Technical Center  
2020 N. Lincoln Street  
Burbank, CA 91504  
(213) 849-4641

**CA, Santa Clara**

Fluke Technical Center  
2300 Walsh Avenue  
Santa Clara, CA 95050  
(408) 985-1200

**CO, Denver**

Fluke Technical Center  
1980 S. Quebec Street, Unit 4  
Denver, CO 80231  
(303) 750-1228

**FL, Orlando**

Fluke Technical Center  
940 N. Fern Creek Avenue  
Orlando, FL 32803  
(305) 896-2296

**IL, Rolling Meadows**

Fluke Technical Center  
1400 Hicks Road  
Rolling Meadows, IL 60008  
(312) 398-5800

**MA, Waltham**

Fluke Technical Center  
244 Second Avenue  
Waltham, MA 02154  
(617) 890-1604

**MD, Rockville**

Fluke Technical Center  
5640 Fishers Lane  
Rockville, MD 20852  
(301) 770-1576

**MN, Apple Valley**

Fluke Technical Center  
7373 West 147th Street, Suite 196  
Apple Valley, MN 55124  
(612) 432-9400

**NC, Greensboro**

Fluke Technical Center  
1310 Beaman Place  
Greensboro, NC 27408  
(919) 273-1918

**NJ, Paramus**

Fluke Technical Center  
West 75th Century Road  
Paramus, NJ 07652  
(210) 262-9550

**TX, Dallas**

Fluke Technical Center  
14400 Midway Road  
Dallas, TX 75240  
(214) 233-9945

**WA, Everett**

John Fluke Mfg. Co., Inc.  
6920 Seaway Blvd.  
Everett, WA 98203  
(206) 342-6300

**CANADA****ALB, Calgary**

Allan Crawford Assoc., Ltd.  
1935 30th Avenue N.E. #14  
Calgary, ALB T2E 6Z5  
(403) 230-1341

**ONT, Mississauga**

Allan Crawford Assoc., Ltd.  
6503 Northam Drive  
Mississauga, ONT L4V 1J5  
(416) 678-1500

**QUE, St. Laurent**

Allan Crawford Assoc., Ltd.  
7018 Cote de Liesse  
St. Laurent, QUE H4T 1E7  
(514) 731-8564

Table 2-2. Fluke Technical Service Centers - International

**ARGENTINA**

Fluke Latin American  
Service Headquarters  
Virrey del Pino 4071  
Buenos Aires, Argentina  
Tel: 523185

**AUSTRALIA**

Elmeasco Instrument Pty Ltd.  
P.O. Box 30  
Concord, N.S.W.  
Australia 2137  
Tel: (02) 736-2888

**AUSTRIA**

Walter Rekersch  
Elektronische Gerate GmbH & Co.  
Vertriebs-KG.  
Lichtensteinstrasse 97/6  
A-1090 Vienna, Austria  
Tel: 09-43-222-347646

**BELGIUM**

Fluke (Belgium) S.A./N.V.  
6, Rue de Geneve  
1140 Brussels, Belgium  
Tel: 09-32-2-2164090

**BRAZIL**

Arotec S.A.  
Industria e Comercio  
Av. Pacaembu 811  
01234 Sao Paulo S.P., Brazil  
Tel: 826-2266

**CHILE**

Intronica Chile Ltda.  
Casilla 16228  
Santiago 9, Chile  
Tel: 44940

**COLOMBIA**

Coasin Ltda.  
Carrera 13, # 37-37, Of. 407  
Ap. Aero 29583  
Bogota DE, Colombia  
Tel: 285-0230

**DENMARK**

Tage Olsen A/S  
Ballerup Byvej 222  
DK-2750 Ballerup  
Denmark  
Tel: (01) 2-65 81 11

**ECUADOR**

Proteco Coasin Cia., Ltda.  
Edificio "Jericó"  
Ave. 12 de Octubre #2285y  
Ave. Orellana (Planta Baja)  
Quito, Ecuador  
Tel: 526759

**EGYPT**

Lotus Engineering Organisation  
P.O. Box 1252  
Cairo, Egypt  
Tel: 71617

**FINLAND**

Oy Findip AB  
Teollisuustie 7  
02700 Kauniainen  
Finland  
Tel: 09-358-0-502255

**FRANCE**

M.B. Electronique S.A.  
Rue Fourny  
ZAC de BUC  
B.P. #31  
78530 BUC, France  
Tel: 09-33-1-9568131

**GREECE**

Hellenic Scientific  
Representations Ltd.  
11, Vrassida Street  
Athens 615, Greece  
Tel: 09-30-1-711140

**HONG KONG**

Gilman Industrial Bldg., 9F  
107-109 Wai Yip Street  
Kwun Tong  
Kowloon, Hong Kong  
Tel: 3-427144

**INDIA**

Hinditron Services Pvt. Ltd.  
"Hinditron House"  
412 Raj Mahal Vilas Extension  
Bangalore 560 006, India  
Tel: 33139

Hinditron Services Pvt. Ltd.  
69 A.L. Jagmohandas Marg  
Bombay 400 006, India  
Tel: 365344

**INDONESIA**

P.T. Dwi Tunggal Jaya Sakti  
Sangga Buana Bldg., 1st Floor  
J1. Senen Raya 44, P.O. Box 4435  
Jakarta, Indonesia  
Tel: 376608

**IRAN**

Irantronics Company Ltd.  
20 Salm Road  
Roosevelt Avenue  
Tehran, Iran  
Tel: 828294/831564

**ISRAEL**

R.D.T. Electronics Engineering Ltd.  
P.O. Box 75  
46, Sokolov Street  
Ramat Hasharon 47235  
Israel  
Tel: 09-972-3-483211

**ITALY**

Sistrel S.p.A.  
Via Timavo 66  
20099 Sesto S. Giovanni (Milan)  
Italy  
Tel: 09-39-2-2476693

**SISTREL S.P.A.**

Via Guiseppe Armellini #37  
00143 Rome, Italy  
Tel: 09-39-6-5915551

**JAPAN**

John Fluke Mfg. Co., Inc.  
Japan Branch  
1 Higashikata-machi  
Midori-ku  
Yokohama 226, Japan  
Tel: (045) 473-5425

**KOREA**

Electro-Science Korea Co.  
C.P.O. Box 8446  
Room 1201 Bowon Bldg.  
490 Chongro - 5 Ka  
Chongro-ku  
Seoul, Korea  
Tel: 261-7702

**MALASIA**

O'Connor's (Malaysia) SDN. BHD.  
P.O. Box 91  
Petaling Jaya, Selangor  
West Malaysia  
Tel: 51563

Table 2-2. Fluke Technical Service Centers - International (cont)

**MEXICO**

C.J. Christensen S.A. De C.V.  
Melchor Ocampo 150-8  
Mexico 4 D.F., Mexico  
Tel: (905) 535-2258

**NETHERLANDS**

Fluke (Nederland) B.V.  
P.O. Box 5053  
5004 EB Tilburg  
The Netherlands  
Tel: (013) 673973

**NEW ZEALAND**

W & K McLean Ltd.  
P.O. Box 18065  
Glen Innes  
Auckland, New Zealand  
Tel: 587-037

**NORWAY**

Morgenstjerne & Co. A/A  
Konghellegate 3  
P.O. Box 6688, Rodelokka  
Oslo 5, Norway  
Tel: 09-47-2-356110

**PAKISTAN**

Pak International Operations  
505 Mohammadi House  
1.1. Chundrigar Road  
Katrachi-2 Pakistan  
Tel: 221127/239052

**PERU**

Importaciones Y Representaciones  
Electronicas S.A.  
Avda. Franklin D. Roosevelt 105  
Lima 1, Peru  
Tel: 288650

**PORTUGAL**

Equipamentos de Laboratorio, Ltda  
P.O. Box 1100  
Lisbon 1002, Portugal  
Tel: 09-351-1-578936/547512

**REPUBLIC OF SINGAPORE**

Rank O'Connor's (PTE) Ltd  
98 Pasir Panjang Road  
Singapore 0511  
Republic of Singapore  
Tel: 637944

**REPUBLIC OF SOUTH AFRICA**

Fluke S.A. (Pty) Ltd.  
P.O. Box 39797  
Bramley 2018  
Republic of South Africa  
Tel: (011) 786-3170

**SPAIN**

Hispano Electronica S.A.  
Apartado de Correos 48  
Alcorcon (Madrid)  
Spain  
Tel: 09-3416194108

**SWEDEN**

Teleinstrument AB  
P.O. Box 490  
S-162 Vallingby 4  
Sweden  
Tel: 09-46-8-380370

**SWITZERLAND**

Traco Electronic AG  
Jenatschstrasse 1  
8002 Zurich  
Switzerland  
Tel: 09-41-1-2010711

**TAIWAN**

CCT Associates, Inc  
P.O. Box 24209  
Taipei, Taiwan  
Republic of China  
Tel: (02) 391-6894/393-5760

**THAILAND**

Dynamic Supply Engineering R.O.P.  
# 56 Ekamai, Sukhumvit 63  
Bangkok-11, Thailand  
Tel: 914434/928532

**TURKEY**

Erkman Elektronik Aletler  
Ticaret Anonim Sirketi  
Necatibey Cad 92/3  
Karakoy, Istanbul, Turkey  
Tel: 09-44-1-5461

**UNITED KINGDOM**

Fluke International Corp. - UK  
Colonial Way  
Watford, Herts. WD24TT  
United Kingdom  
Tel: 09-4492340511

**URUGUAY**

Coasin Uruguay S.R.L.  
Edificio Ciudadela  
Sarandi 690 D. Esc. 109  
Casilla de Correos 1400  
Correo Central  
Montevideo, Uruguay  
Tel: 917978

**VENEZUELA**

Coasin C.A.  
Apdo. Postal 50939  
Sabana Grande # 1  
Caracas 105, Venezuela  
Tel: 782-9109

**WEST GERMANY**

Fluke (Deutschland) GmbH  
Krausstrasse 32  
8045 Ismaning  
West Germany  
Tel: (089) 96251

Customers in the following countries: Bulgaria, Czechoslovakia, Hungary, Poland, Romania, U.S.S.R., and Yugoslavia, contact:  
Amtest Associates Ltd., P.O. Box 55, Addlestone, Surrey, KT 15 1DU, England, Tel. (0932) 52121

Table 2-3. Sales Representatives - U.S. and Canada

**UNITED STATES****AK, Anchorage**

Harry Lang & Associates  
1371 Hillcrest Drive #303  
Anchorage, AK 99503  
(907) 279-5741

**AL, Huntsville**

John Fluke Mfg. Co., Inc.  
3322 Memorial Parkway  
Huntsville, AL 35807  
(205) 881-6220  
(404) 321-0980 (Atlanta)

**AZ, Tempe**

John Fluke Mfg. Co., Inc.  
2125 S. 48th Street, Suite 104  
Tempe, AZ 85285  
(602) 967-8724

**CA, Los Angeles**

John Fluke Mfg. Co., Inc.  
20902 S. Bonita Street  
Carson, CA 90746  
(213) 538-3900

**CA, Santa Clara**

John Fluke Mfg. Co., Inc.  
2300 Walsh Avenue  
Santa Clara, CA 95050  
(408) 244-1505

**CA, Tustin**

John Fluke Mfg. Co., Inc.  
15445 Red Hill Avenue, Suite F  
Tustin, CA 92680  
(714) 838-8863  
(714) 226-1254 (San Diego)

**CO, Denver**

John Fluke Mfg. Co., Inc.  
1980 S. Quebec, #4  
Denver, CO 80231  
(303) 750-1222

**CT, Hartford**

John Fluke Mfg. Co., Inc.  
124 Hebron Avenue  
Glastonbury, CT 06033  
(203) 633-0777

**FL, Orlando**

John Fluke Mfg. Co., Inc.  
940 N. Fern Creek Avenue  
Orlando, FL 32803  
(305) 896-4881

**HI, Honolulu**

EMC Corporation  
2979 Ualena Street  
Honolulu, HI 96819  
(808) 847-1138

**IA, Iowa City**

John Fluke Mfg. Co., Inc.  
1027 Hollywood Blvd., Suite 309  
Iowa City, IA 52240  
(319) 354-2811

**IL, Chicago**

John Fluke Mfg. Co., Inc.  
4300 Lincoln, Unit K  
Rolling Meadows, IL 60008  
(312) 398-0850

**IN, Indianapolis**

John Fluke Mfg. Co., Inc.  
5610 Crawfordsville Road,  
Suite 802  
Indianapolis, IN 46224  
(317) 244-2456

**LA, Metairie**

John Fluke Mfg. Co., Inc.  
2700 Kingman Street, Suite 103  
Metairie, LA 70002  
(504) 455-0814

**MA, Waltham**

John Fluke Mfg. Co., Inc.  
244 Second Avenue  
Waltham, MA 02154  
(617) 890-1600

**MD, Baltimore**

John Fluke Mfg. Co., Inc.  
5640 Fishers Lane  
Rockville, MD 20852  
(301) 770-1570  
(301) 792-7060 (Baltimore)

**MI, Detroit**

John Fluke Mfg. Co., Inc.  
13955 Farmington Road  
Livonia, MI 48154  
(313) 522-9140

**MN, Minneapolis**

John Fluke Mfg. Co., Inc.  
7373 W. 147th Street, Suite 196  
Apple Valley, MN 55124  
(612) 432-9400

**MO, Kansas City**

John Fluke Mfg. Co., Inc.  
4406 Chouteau Traffic Way  
Kansas City, MO 64117  
(816) 454-5836

**MO, St. Louis**

John Fluke Mfg. Co., Inc.  
300 Brookes Drive, Suite 100  
Hazelwood, MO 63042  
(314) 731-3388

Table 2-3. Sales Representatives - U.S. and Canada (cont)

**NC, Greensboro**

John Fluke Mfg. Co., Inc.  
1310 Beaman Place  
Greensboro, NC 27408  
(919) 273-1918

**NJ, Paramus**

John Fluke Mfg. Co., Inc.  
West 75 Century Road  
Paramus, NJ 07625  
(201) 262-9550

**NM, Albuquerque**

John Fluke Mfg. Co., Inc.  
1108 Alvarado Drive N.E.  
Albuquerque, NM 87110  
(505) 265-8431

**NY, Rochester**

John Fluke Mfg. Co., Inc.  
4515 Culver Road  
Rochester, NY 14622  
(716) 266-1400

**OH, Cleveland**

John Fluke Mfg. Co., Inc.  
7830 Freeway Circle  
Middleburg Heights, OH 44130  
(216) 234-4540

**OH, Dayton**

John Fluke Mfg. Co., Inc.  
4756 Fishburg Road  
Dayton, OH 45424  
(513) 233-2238

**OR, Portland**

John Fluke Mfg. Co., Inc.  
18360 S.W. Springfield Lane  
Aloha, OR 97006  
(502) 642-1342

**PA, Philadelphia**

John Fluke Mfg. Co., Inc.  
1010 W. 8th Avenue, Suite H  
King of Prussia, PA 19406  
(215) 265-4040  
(412) 261-5171 (Pittsburgh)

**TX, Austin**

John Fluke Mfg. Co., Inc.  
111 W. Anderson Lane, Suite 213  
Austin, TX 78752  
(512) 478-9901

**TX, Dallas**

John Fluke Mfg. Co., Inc.  
14400 Midway Road  
Dallas, TX 75243  
(214) 233-9990

**TX, Houston**

John Fluke Mfg. Co., Inc.  
1014 Wirt Road, Suite 270  
Houston, TX 77055  
(713) 683-7913  
(512) 222-2726 (San Antonio)

**UT, Salt Lake City**

John Fluke Mfg. Co., Inc.  
782 E. 8325 South  
Sandy, UT 84070  
(801) 566-4864

**WA, Kennewick**

John Fluke Mfg. Co., Inc.  
3613 W. 16th Place #C  
Kennewick, WA 99336

**WA, Seattle**

John Fluke Mfg. Co., Inc.  
975 Industry Drive  
Seattle, WA 98188  
(206) 575-3765

**CANADA****ALB, Calgary**

Allan Crawford Assoc., Ltd.  
1935 30th Avenue N.E., #14  
Calgary, ALB T2E 6Z5  
Tel: (403) 230-1341

**BC, North Vancouver**

Allan Crawford Assoc., Ltd.  
3795 William Street  
Burnaby, BC V5C 3H3  
Tel: (604) 294-1326

**NS, Halifax**

Allan Crawford Assoc., Ltd.  
Townsend Place, Suite 201  
800 Windmill Road  
Burnside Industrial Park  
Dartmouth, NS B3B 1L1  
Tel: (902) 469-7865

**ONT, Ottawa**

Allan Crawford Assoc., Ltd.  
1299 Richmond Road  
Ottawa, ONT K2B 7Y4  
Tel: (613) 829-9651

**ONT, Toronto**

Allan Crawford Assoc., Ltd.  
6503 Northam Drive  
Mississauga, ONT L4V 1J5  
Tel: (416) 678-1500

**QUE, Montreal**

Allan Crawford Assoc., Ltd.  
7018 Cote de Liesse  
St. Laurent, QUE H4T 1E7  
Tel: (514) 731-8564

For more information on Fluke products or Sales Offices you may dial (800) 426-0361 toll free in most of U.S.  
From Alaska, Hawaii, Washington, or Canada phone (206) 774-2481. From other countries phone (206) 774-2398.

For Canadian areas not listed, contact the office nearest you or Allan Crawford Assoc. Ltd., Mississauga (Toronto), Ontario.

Table 2-4. Sales Representatives - International

Supplied and Supported by Fluke International Corporation, P.O. Box 43210, Mountlake Terrace, WA 98043, Tel: (206) 774-2398,  
TLX: 152662 JOHNFILUKE MTLT

**ARGENTINA**

Coasin S.A.  
Virrey del Pino 4071  
Buenos Aires, Argentina  
Tel: 525130  
TLX: 390122284 COASN AR

**AUSTRALIA**

Elmeasco Instruments Pty Ltd.  
P.O. Box 30  
Concord, N.S.W.  
Australia 2137  
Tel: (2) 736-2888  
TLX: 79025887

Elmeasco Instruments Pty Ltd.  
P.O. Box 107  
Mt. Waverly, VIC. 3149  
Australia  
Tel: 233-4044  
TLX: 26206 (ELMVIC)

Elmeasco Instruments Pty Ltd.  
Professional Suite's Bldg.  
B.P.O. Box 2360  
Brisbane, 4001  
Australia  
Tel: (07) 229-3161

Elmeasco Instruments Pty Ltd.  
P.O. Box 1240  
G.P.O. Adelaide 5001  
South Australia

**BOLIVIA**

Coasin Bolivia S.R.L.  
Casilla 7295  
La Paz, Bolivia  
Tel: 40962  
TLX: Public Booth # 5377, indicate  
"Para Coasin B.S.R.L., Av 6  
de Agosto 2300 3er Piso, La Paz  
tl 40962"

**BRAZIL**

Arotec S.A.  
Industria e Comercio  
Av. Pacaembu 811  
01234 Sao Paulo S.P., Brazil  
Tel: (011) 67-2393  
TLX: 1122207 AROT BR

Arotec S.A.  
Rua Araguaia, 1705 s 402  
30.000 Belo Horizonte M.G., Brazil

Arotec S.A.  
Av. Rio Branco 277  
Grupo 1309  
02000 Rio de Janeiro, R.J., Brazil  
Tel: (021) 242-9776

**BRUNEI**

O'Connor's Limited  
(Brunei Branch) Chin Kian Bldg.  
P.O. Box 2126  
Bandar Seri Begawan, Brunei  
Tel: 26680

**CHILE**

Intronica Chile Ltda.  
Manuel Montt 024 - Of. D  
Casilla 16228  
Santiago 9, Chile  
Tel: 44940  
TLX: 40301 Cab Publ.,  
Attn: Intronica Chile

**CHINA, PEOPLE'S REPUBLIC OF**

China National Instrument Import  
& Export Corp.  
P.O. Box 49, Erh-Li-Kou  
Hsi Chi'ao  
Beijing  
People's Republic of China  
TLX: CO 2242 CNIEC

**COLOMBIA**

Coasin Ltda.  
Carrera 13, # 37-37, Of. 407  
Ap. Aero 29583  
Bogota DE, Colombia  
St. 285-0230/0250  
TLX: 45787 COASN CO

**ECUADOR**

Proteco Coasin Cia., Ltda.  
Edificio "Jerico"  
Ave. 12 de Octubre #2285 y  
Ave. Orellana (Planta Baja)  
Quito, Ecuador  
Tel: 529684  
TLX: 2865 Protec Ed

Proteco Coasin Cia., Ltda  
Casilla 9733  
9 de Octubre 424  
Edificio Gran Pasaje, Of. 1012  
Guayaquil, Ecuador

Table 2-4. Sales Representatives - International (cont)

**HONG KONG**

Gilman & Co., Ltd.  
P.O. Box 56  
Gilman Ind. Bldg. 9 F  
107-109 Wai Yip Street  
Kwun Tong, Kowloon  
Hong Kong  
Tel: 5-7909633  
TLX: 73358 GILMN HX

**ICELAND**

Kristjan O. Skagfjord Ltd.  
P.O. Box 906  
Reykjavik, Iceland  
Tel: 24120  
TLX: 2133 KOS-1S

**INDIA**

Hinditron Services Pvt. Ltd.  
69 A.L., Jagmohandas Marg  
Bombay 400 006  
India  
Tel: 811316  
TLX: 953-112326 Hspl In

Hinditron Services Pvt. Ltd.  
"Hinditron House"  
412 Raj Mahi Vilas Extension  
Bangalore 560 006  
India  
Tel: 33139  
TLX: 043741

**INDONESIA**

P.T. Dwi Tunggal Jaya Sakti  
Sangga Buana Bldg., 1st Floor  
Jl. Senen Raya 44, P.O. Box 4435  
Jakarta, Indonesia  
Tel: 367390-9  
TLX: 46624 SABUANA 1A

P.T. Dwi Tunggal Jaya Sakti  
Jalan Sasakgantung 45  
Bandung, Indonesia  
Tel: 367390-9  
TLX: 46624 SABUANA 1A

**JAPAN**

John Fluke Mfg. Co., Inc.  
Japan Branch  
(PC Board Testers only)  
1 Higashikata-machi  
Midori-ku  
Yokohama 226, Japan  
Tel: (045) 473-5425  
TLX: 3823-666 FLUKJJP

Tokyo Electron Ltd.  
38 Fl. Shinjuko Nomura Bldg.  
1-26-2, Nishi-Shinjuku  
Shinjuku-ku  
Tokoyo 160, Japan  
Tel: 03-343-4411  
TLX: 2322220 LABTEL J

**KENYA**

ADCom Limited Inc.  
P.O. Box 30070  
Nairobi, Kenya  
East Africa  
Tel: 331955  
TLX: 22639 ADCOM

**KOREA**

Electro-Science Korea Co.  
C.P.O. Box 8446  
Room. 1201 Bowon Bldg.  
490 Chongro - 5 Ka  
Chongro-ku  
Seoul, Korea  
Tel: 261-7702  
TLX: 78723270+

**MALAYSIA**

O'Connor's (PTE) Limited  
P.O. Box 91  
Petaling Jaya, Selangor  
West Malaysia  
Tel: 51563  
TLX: OCONOR MA37649

O'Connor's (PTE) Limited  
Lot # 5 Taman Mesra  
Mile 3, Jalan Penampang  
Kota Kinabalu  
East Malaysia  
Tel: 55322  
TLX: MA80286FL

**MEXICO**

C.J. Christensen S.A. De C.V.  
Instrumentos Electronicos  
de Medicion  
Melchor Ocampo 150-8  
Mexico 4 D.F., Mexico  
Tel: (905) 535-2258

**NEW ZEALAND**

W & K McLean Ltd.  
P.O. Box 18065  
Glen Innes  
Auckland, New Zealand  
Tel: 587-037  
TLX: N.Z. 7912763

W & K McLean Ltd.  
P.O. Box 2421  
Christchurch, New Zealand

W & K McLean Ltd.  
P.O. Box 496  
Wellington, New Zealand  
Tel: 851-450

**NIGERIA**

Mofat Engineering Co., Ltd.  
P.O. Box 6369  
Lagos, Nigeria  
TLX: 21353, Attn: MOFAT

**PAKISTAN**

Pak International Operations  
505 Mohammadi House  
- McLeod Road  
P.O. Box 5323  
Karachi, Pakistan  
Tel: 221127  
TLX: 24494 PIO PK

**PERU**

Importaciones Y Representaciones  
Electronicas S.A.  
Avda. Franklin D. Roosevelt 105  
Lima 1, Peru  
Tel: 288650  
TLX: 37425663

**PHILIPPINES**

Spark Radio and Electric Supply  
P.O. Box 1333  
Manila, Philippines  
Tel: 473183  
TLX: 27901 RLA PH

**SINGAPORE**

Rank O'Connor's (PTE) Limited  
98 Pasir Panjang Road  
Singapore 0511  
Republic of Singapore  
Tel: 637944  
TLX: OCONSIN RS21023

**SOUTH AFRICA**

Fluke S.A. (Pty) Ltd.  
P.O. Box 39797  
Bramley 2018  
Republic of South Africa  
Tel: (011) 786-3170  
TLX: 82899

**TAIWAN**

CCT Associates, Inc.  
P.O. Box 24209  
Taipei, Taiwan  
Republic of China  
Tel: (02) 391-6894  
TLX: 24263 Longgulf

**THAILAND**

Dynamic Supply Engineering R.O.P.  
# 56 Ekamai, Sukhumvit 63  
Bangkok-11, Thailand  
Tel: 914434  
TLX: TH 82938 MONTIEN TH

**URUGUAY**

Coasin Uruguaya S.R.L.  
Edif. Ciudadela  
Sarandi 690 D. Esc. 109  
Casilla de Correos 1400  
Correo Central  
Montevideo, Uruguay  
Tel: 917978  
TLX: Public Booth UY901 Coasin

**VENEZUELA**

Coasin C.A.  
Apdo. Postal 50939  
Sabana Grande # 1  
Caracas 105, Venezuela  
Tel: 782-9109-8741  
TLX: 39531228

**Latin America also Supported by -**

Sr. Leonardo Cusnir, c/o COASIN A.A., Virrey del Pino 4071, Buenos Aires, Argentina, Tel: 523185, TLX: 390122284 COASN AR  
Sr. Benewaldo Padovani, c/o AROTEC S.A., Industria e Comercio, Av. Pacaembu 811, 01234 Sao Paulo S.P., Brazil, Tel: (011) 67-2393,  
TLX: 1122207 AROT BR

Supplied and Supported by Fluke (Holland) B.V., P.O. Box 5053, Zevenhevelenweg 53, 5004 EB Tilburg, Netherlands, Tel: (013) 673973,  
TLX: 522337

**AUSTRIA**

Walter Rekirsch  
Electronische Gerate GmbH & Co.  
Vertriebs-KG  
Liechtensteinstrasse 97/6  
A-1090 Vienna, Austria  
Tel: (222) 347646  
TLX: 134759

**BELGIUM**

Fluke (Belguim) S.A./N.V.  
6 Rue de Geneve  
1140 Brussels, Belgium  
Tel: (2) 2164090  
TLX: 26312

**BULGARIA**

Amtest Associates Ltd.  
P.O. Box 55  
Addlestone, Surrey KT15 1DU  
United Kingdom  
Tel: Weybridge (923) 52121  
TLX: 928855

**CHAD**

Fluke (Holland) B.V.  
P.O. Box 5053  
Zevenhevelenweg 53  
5004 EB Tilburg, Netherlands  
Tel: (013) 673973  
TLX: 52237

**CYPRUS**

Chris Radiovision Ltd.  
P.O. Box 1989  
Nicosia, Cyprus  
Tel: 66121  
TLX: 2395

**CZECHOSLOVAKIA**

Amtest Associates Ltd.  
P.O. Box 55  
Addlestone, Surrey KT15 1DU  
United Kingdom  
Tel: Weybridge (932) 52121  
TLX: 928855

**DENMARK**

Tage Olsen A/S  
Ballerup Byvej 222  
DK - 2750 Ballerup, Denmark  
Tel: (2) 658111  
TLX: 35293

**EGYPT AND SUDAN**

Lotus Engineering Organisation  
P.O. Box 1252  
22, Kasi El Nil  
Cairo, Egypt  
Tel: 971617  
TLX: 92504

Table 2-4. Sales Representatives - International (cont)

**EIRE (REPUBLIC OF IRELAND)**

Euro Electronics  
32 Brews Hill  
Naven, County Meath  
Tel: 46-23577  
TLX: 31821

**ETHIOPIA**

Fluke (Holland) B.V.  
P.O. Box 5053  
Zevenheuvelenweg 53  
5004 EB Tilburg, Netherlands  
Tel: (013) 673973  
TLX: 52237

**FINLAND**

Oy Findip AB  
Teollisuustie 7  
02700 Kauniainen, Finland  
Tel: (0) 502255  
TLX: 123129

**FRANCE**

M.B. Elctronique S.A.  
Rue Fourny  
ZAC de BUC  
B.P. # 31  
78530 BUC, France  
Tel: (1) 9568131  
TLX: 695414

**GERMAN DEMOCRATIC REPUBLIC**

Amtest Associates Ltd.  
P.O. Box 55  
Addlestone, Surrey KT15 1DU  
United Kingdom  
Tel: Weybridge (932) 52121  
TLX: 928855

**GERMAN FEDERAL REPUBLIC**

Fluke (Deutschland) GmbH  
Krausstrasse 55  
8045 Ismaning  
West Germany  
Tel: (089) 96251  
TLX: 0522472  
Rapitax: (089) 966718

Fluke (Deutschland) GmbH  
Meineckestrasse 53  
4000 Dusseldorf 30  
West Germany  
Tel: (0211) 450831  
TLX: 8585576

Fluke (Deutschland) GmbH  
Oberer Kirchhaldenweg 135  
7000 Stuttgart 1  
West Germany  
Tel: (0711) 694091  
TLX: 722518

PK Elektronik  
Lietzenburger Strasse 91  
1000 Berlin 15  
West Germany  
Tel: (030) 8831058

**GREECE**

Hellenic Scientific  
Representations Ltd.  
11, Vrasside Street  
Athens 615, Greece  
Tel: (1) 711140  
TLX: 219330

**HUNGARY**

Amtest Associates Ltd.  
P.O. Box 55  
Addlestone, Surrey KT15 1DU  
United Kingdom  
Tel: Weybridge (932) 52121  
TLX: 928855

**IRAN**

Irantronics Company Ltd.  
20, Salm Road  
Roosevelt Avenue  
Tehran, Iran  
Tel: 828294/831564  
TLX: 212956/212876

**IRAQ**

Fluke (Holland) B.V.  
P.O. Box 5053  
Zevenheuvelenweg 53  
5004 EB Tilburg, Netherlands  
Tel: (013) 673973  
TLX: 52237

**IRELAND**

Euro Electronics  
32 Brews Hill  
Naven County Meath  
Ireland  
Tel: (46) 23577  
TLX: 3182

**ISRAEL**

R.D.T. Electronics Engineering Ltd.  
P.O. Box 75  
46, Sokolov Street  
Ramat Hasharon 47235  
Israel  
Tel: (3) 483211  
TLX: 32143

**ITALY**

Sistrel S.p.A.  
Via Giuseppe Armellini # 37  
00143 Rome, Italy  
Tel: (6) 5915551  
TLX: 680356

Sistrel S.p.A.  
Via Timavo 66  
20099 Sesto S. Giovanni (Milan)  
Italy  
Tel: (2) 2476693  
TLX: 320346

Sistrel S.p.A.  
Via Cintia  
Parco S. Paolo 35  
80126 Naples, Italy  
Tel: (81) 7679700

**KUWAIT**

Tareq Company  
P.O. Box Safat 20506  
Kuwait, Arabian Gulf  
Tel: 436100/436045  
TLX: 2315

**LEBANON AND JORDAN**

Mabek (Electronics Division)  
P.O. Box 11-3823  
Beirut, Lebanon  
Tel: 252631/348728  
TLX: 22889

**LIBYA**

Fluke (Holland) B.V.  
P.O. Box 5053  
Zevenheuvelenweg 53  
5004 EB Tilburg, Netherlands  
Tel: (013) 673973  
TLX: 52237

**MOROCCO**

Mainvest, Residence Moulay Ismail  
Bat. C Boulevard Moulay Slimane  
Rabat, Morocco  
Tel: (7) 27664  
TLX: 31036

**NETHERLANDS**

Fluke (Nederland) B.V.  
P.O. Box 5053  
Zevenheuvelenweg 53  
5004 EB Tilburg, Netherlands  
Tel: (013) 673973  
TLX: 52237

**NORWAY**

Morgenstjerne & Co. A/A  
Konghellegate 3  
P.O. Box 6688, Rodelokka  
Oslo 5, Norway  
Tel: (2) 356110  
TLX: 11719

**PDR YEMEN**

Fluke (Holland) B.V.  
P.O. Box 5053  
Zevenheuvelenweg 53  
5004 EB Tilburg, Netherlands  
Tel: (013) 673973  
TLX: 52237

**POLAND**

Amtest Associates Ltd.  
P.O. Box 55  
Addlestone, Surrey KT15 1DU  
United Kingdom  
Tel: Weybridge (932) 52121  
TLX: 928855

**PORTUGAL**

Equipamentos de Laboratorio, Ltda.  
P.O. Box 1100  
1002 Lisbon, Portugal  
Tel: (1) 578936/547512  
TLX: 18469

**QATER, OMAN & UNITED ARAB EMIRATES**

Technology Organisation  
P.O. Box 5549  
Doha, Qatar  
Tel: 321431  
TLX: 4581

**ROMANIA**

Amtest Associates Ltd.  
P.O. Box 55  
Addlestone, Surrey KT15 1DU  
United Kingdom  
Tel: Weybridge (932) 52121  
TLX: 928855

**SAUDI ARABIA**

Electronic Equipment  
Marketing Co. Ltd.  
P.O. Box 3750  
Riyadh, Saudi Arabia  
Tel: 32761/32700/37023  
TLX: 201120

**SOMALIA**

Fluke (Holland) B.V.  
P.O. Box 5053  
Zevenheuvelenweg 53  
5004 EB Tilburg, Netherlands  
Tel: (013) 673973  
TLX: 52237

**SPAIN**

Hispano Electronica S.A.  
Piligono Industrial Urtinsa  
Apartado de Correos 48  
Alcorcon (Madrid)  
Spain  
Tel: (1) 6194108  
TLX: 22404/42634

**SWEDEN**

Teleinstrument AB  
P.O. Box 490  
S-162 04 Vallingby 4  
Sweden  
Tel: (8) 380370  
TLX: 11347

**SWITZERLAND**

Traco Electronic Company Ltd.  
I. Jenatschstrasse  
Postfach, 8027 Zurich  
Switzerland  
Tel: (1) 2010711  
TXL: 54318

**SYRIA**

Mabek (Electronics Division)  
P.O. Box 4238  
Damascus, Syria

**TURKEY**

Erkman Elektronik Aletler  
Ticaret Anonim Sirketi  
Necatiby Cad 92/3  
Karakoy, Istanbul, Turkey  
Tel: (1) 5461  
TLX: 23353

**UNITED KINGDOM**

Fluke International Corp.-UK  
Colonial Way  
Watford, Herts, WD 24 TT  
United Kingdom  
Tel: (923) 40511

**U.S.S.R.**

Amtest Associates Ltd.  
P.O. Box 55  
Addlestone, Surrey KT15 1DU  
United Kingdom  
Tel: Weybridge (932) 52121  
TLX: 928855

**YEMEN**

Fluke (Holland) B.V.  
P.O. Box 5053  
Zevenheuvelenweg 53  
5004 EB Tilburg, Netherlands  
Tel: (013) 673973  
TLX: 52237

**YUGOSLAVIA**

Amtest Associates Ltd.  
P.O. Box 55  
Addlestone, Surrey KT15 1DU  
United Kingdom  
Tel: Weybridge (932) 52121  
TLX: 928855

Customers in the following countries: Bulgaria, Czechoslovakia, Hungary, Poland, Romania, U.S.S.R., and Yugoslavia, contact:  
Amtest Associates Ltd., P.O. Box 55, Addlestone, Surrey, KT 15 1DU, England, Tel. (0932) 52121

## Section 3

# Theory of Operation

### 3-1. INTRODUCTION

3-2. This section of the manual deals with the 8520A theory of operation. It begins with an explanation of the component numbering and placement system, followed by an overall block diagram and then a detailed description of each block.

### 3-3. COMPONENT NUMBERING SYSTEMS

3-4. The 8520A is laid out on four printed circuit boards designated A1 through A4 plus the switches and connectors mounted on the front and rear panels. The two main boards, which lay flat across the instrument interior, are sectionalized into individual circuits. All components in a section are numbered within a series to identify the section within the assembly. Table 3-1 contains the series identification numbers and their corresponding section titles. A component number A2 R15 identifies resistor R15 in the Digital Controller section of the A2 Digital PCB Assembly. Other examples are: A2 U108 is IC U108 in the IEEE Interface section of the Digital Assembly, A3 BR702 would be bridge rectifier BR702 in the Power Supply section of the A3 Analog Assembly. In many cases the PCB Assembly is identified by name rather than "A" number, but in those cases the component number holds true. Figure 3-1 shows the location placement of the four assemblies within the instrument and of the individual sections on the Digital and Analog Assemblies.

### 3-5. FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

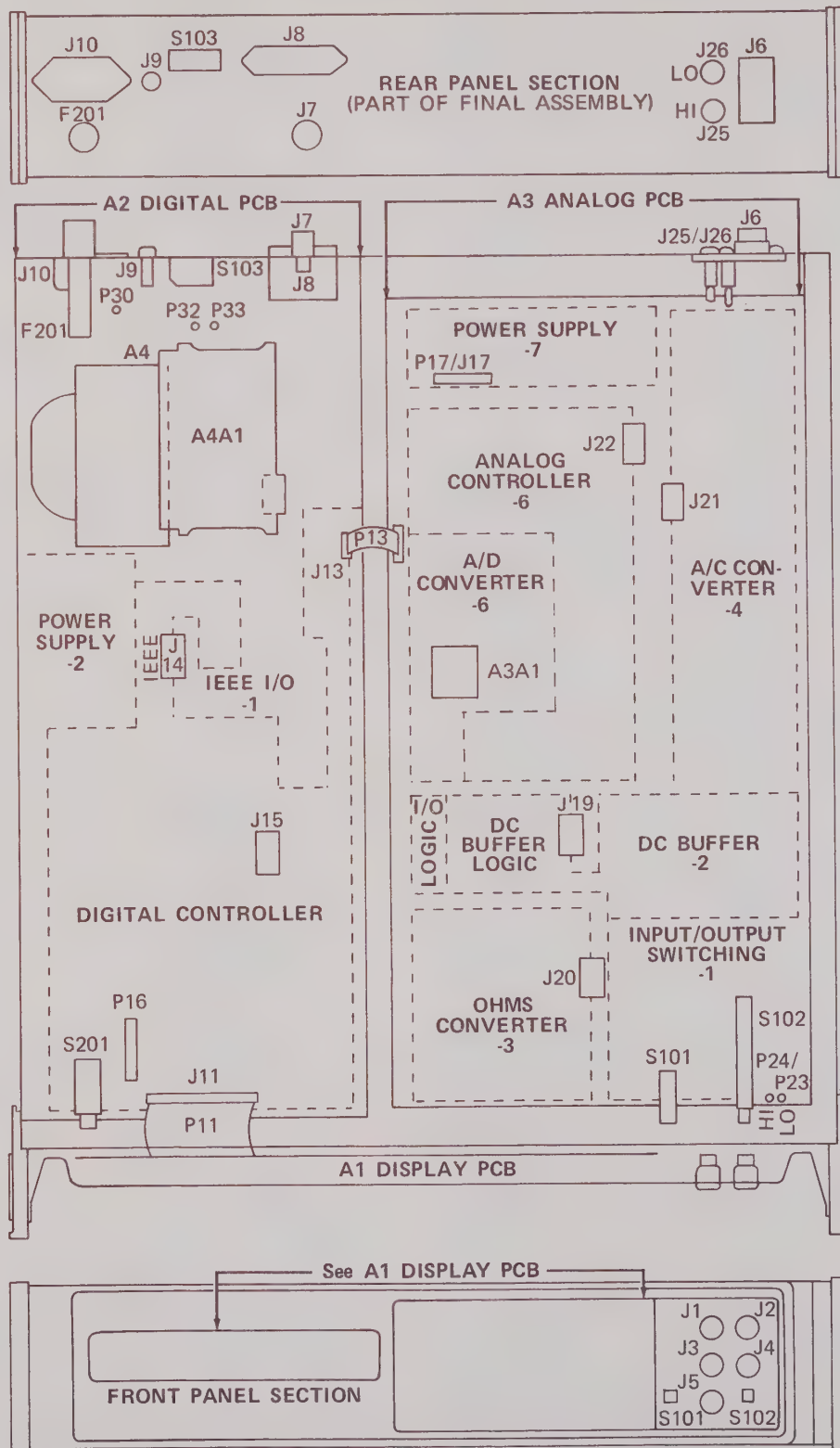
3-6. Figure 3-2 is a block diagram of the circuits within the 8520A. The path of signal flow through the blocks during each of the functions available with the instrument is described in subsequent paragraphs. The signal path varies for each function until the analog data is changed to digital in the A/D Converter. From that point on, the signal flow is the same for all functions.

Table 3-1. Component Identification

| SECTION TITLE      | COMPONENT IDENTIFICATION |
|--------------------|--------------------------|
| Digital PCB        | A2                       |
| Digital Controller | XX                       |
| IEEE Interface     | 1XX                      |
| Power Supply       | 2XX                      |
| Analog PCB         | A3                       |
| I/O Switching      | 1XX                      |
| DC Buffer          | 2XX                      |
| Ohms Converter     | 3XX                      |
| AC Converter       | 4XX                      |
| A/D Converter      | 5XX                      |
| Analog Controller  | 6XX                      |
| Power Supply       | 7XX                      |

### 3-7. DC Volts

3-8. With DC Volts selected, an input between zero and 1000V dc can be applied to the Front Panel Input Terminals and applied to the I/O Switching Circuit. In the 100 and 1000 volt ranges, the signal is divided by 64 to bring it within the  $\pm 16.5$  volt limits of the DC Buffer. The DC Buffer filters the dc input at the selected speed, conditions it to the proper levels and outputs a varying signal, between zero and  $\pm 16.5$  volts, proportional to the input signal. The proportional analog signal is converted to digital data. The signal flow for a dc voltage input is shown in Figure 3-3.



8520A-1303

Figure 3-1. Assembly Placement

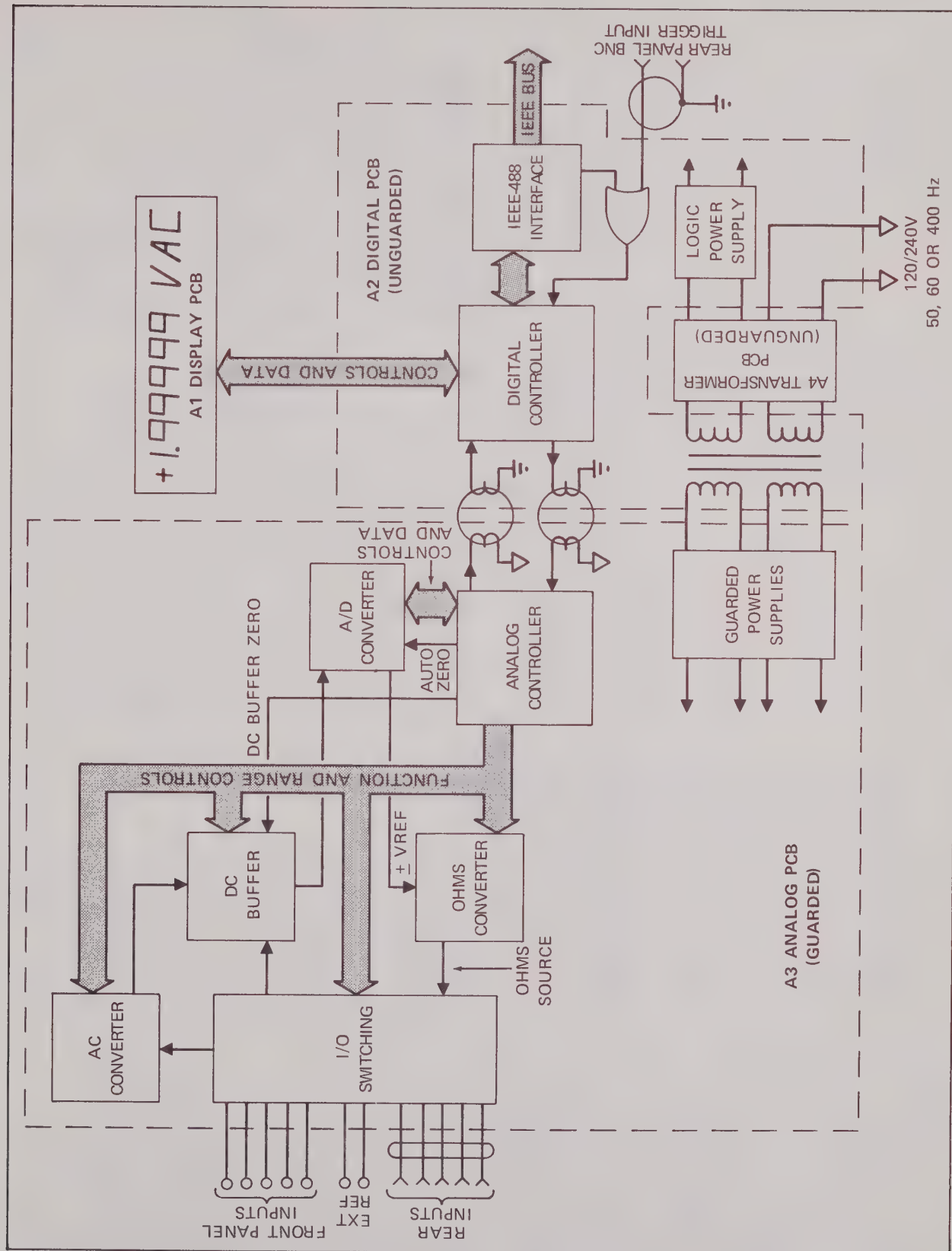


Figure 3-2. 8520A Block Diagram

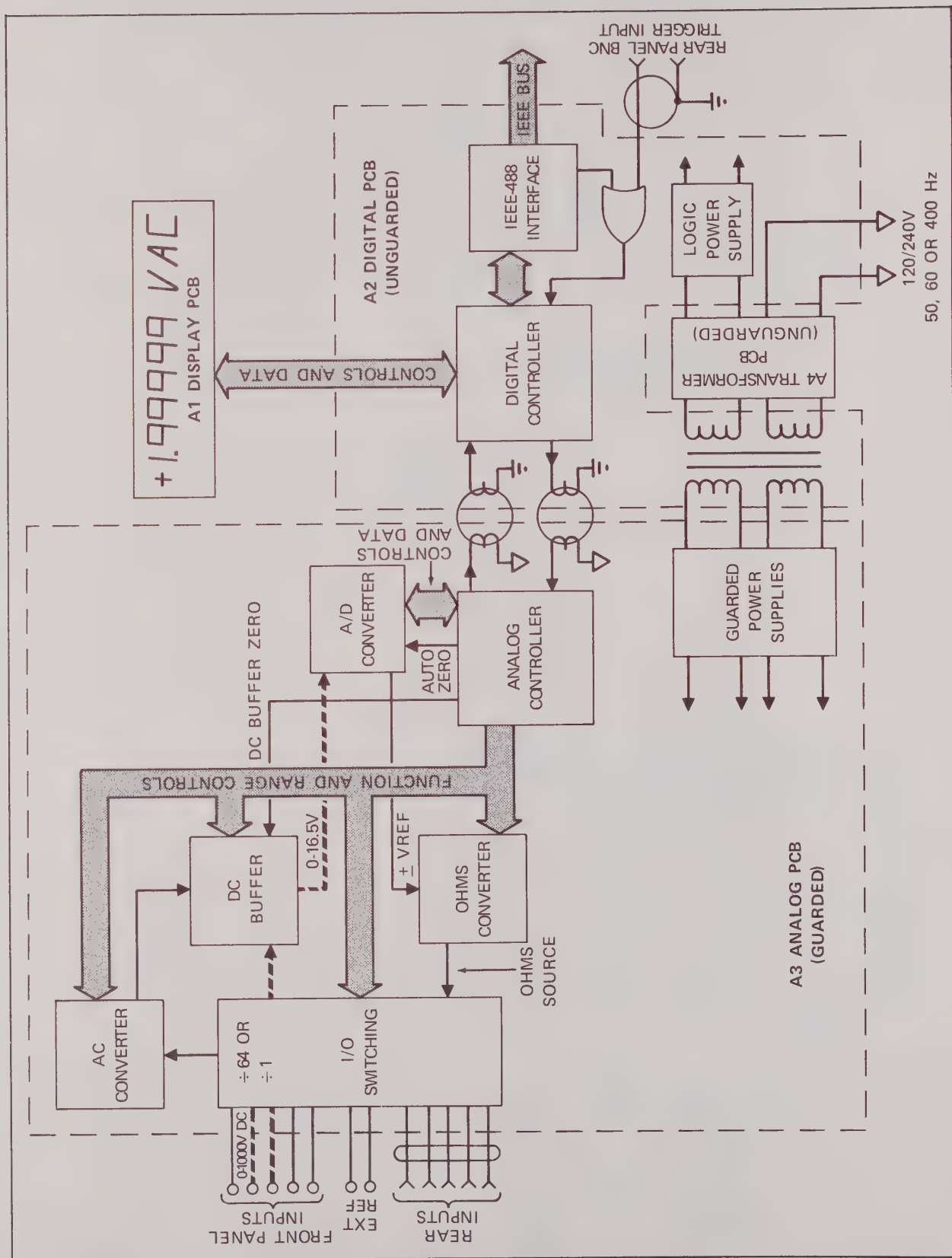


Figure 3-3. DC Volts

### 3-9. AC and AC + DC Volts

3-10. Figure 3-4 shows the signal path when either AC volts or AC + DC volts are selected. The maximum 650V rms or 1000V peak signal is input to the I/O Switching circuit from the input terminals, but is routed directly to the AC Converter without change. Coupling into the AC Converter varies with the function selected, either through a capacitor for ac or around the capacitor for direct coupling for AC + DC. The AC Converter changes the zero to 650V ac input to a zero to 16.5V dc proportional signal and applies it to the DC Buffer. The DC Buffer treats the input just as it did the dc input, filtering, conditioning, and applying it to the A/D Converter for conversion to a digital signal.

### 3-11. Ohms and Nanosiemens

3-12. A resistance measurement is input to the I/O Switching section and then routed without change to the applicable portion of the Ohms Converter, low or high ohms. Measurements are made using a current reference for values of 19.9999 kilohms or less (LO OHMS) or a voltage reference and the ratio technique for values of 20 kilohms or greater (HI OHMS). The resulting voltage drop is proportional to the value of the measured resistance and is routed to the DC Buffer, through the I/O Switching section, and to the A/D Converter for conversion to digital data. Conductance measurements in nanosiemens are treated as a high ohms measurement and then inverted to obtain the reciprocal of the value. Figure 3-5 has the signal flow highlighted for a resistance operation.

### 3-13. External Reference

3-14. Signal flow for an external reference measurement is shown in Figure 3-6. External reference differs from a dc measurement only in the input of the external reference on the rear panel terminals. The input and the reference are multiplexed in the I/O Switching section, and the resultant voltages are sent alternately to the DC Buffer to be conditioned and to the A/D Converter to be changed to digital data. The actual computation of ratio is performed on the two A/D outputs by the Digital Controller.

### 3-15. External Trigger Inputs

3-16. External triggers may originate in one of three different locations as shown in Figure 3-7. These are from the Front Panel MANUAL keyswitch, the rear panel BNC connector if enabled, and the IEEE Bus if addressed. Once in the Digital Controller, trigger action does not vary between the external triggers and the internal trigger.

### 3-17. Digital Data Flow

3-18. Data is converted to a digital format in the A/D Converter which operates in combination with the Analog Controller. Switching signals for control of the analog functions are sent from the Digital Controller to the Analog Controller which latches the information and sends it to the applicable section. A/D Converter outputs are sent over the guard crossing to the Digital Controller and then processed as required for display or transmission over the IEEE-488 Bus.

### 3-19. DETAILED DESCRIPTION

3-20. A description of each operational section in the block diagram is given in the paragraphs below. The Power Supply circuits are described first, followed by the Display, Digital, and Analog Assemblies. The Power Supply has portions of its circuitry on both the Analog and Digital Assemblies, as well as on the Transformer Assembly. Refer to the schematic listed after the paragraph title during the discussion of the circuit.

### 3-21. Power Supply (8520A-1023)

3-22. The Power Supply schematic is a combination drawing including components located on the Digital Assembly (A2), the Analog Assembly (A3), the Transformer Assembly (A4), the front and rear panels, and transformer T201. Input line voltage is routed to the transformer primary through the front panel power switch and the line voltage selection switches on the Transformer Assembly.

3-23. Two secondary windings go to the analog assembly for the guarded power supplies. One secondary goes to the regulator through the rectifiers CR703 and CR704 to provide the +5 volts for the logic circuits. This is accomplished by tying -15 volts to logic high which puts logic common at -20 volts with respect to analog common. The other secondary is rectified by the bridge network BR701 for  $\pm 15$  volt outputs from regulators U705 (+15V) and U706 (-15V). Another tap from the same secondary is rectified in BR702 for  $\pm 27$  volt outputs from U704 (+27V) and U707 (-27V).

3-24. On the Digital Assembly, the regulator U202 takes the rectified output from CR1 and CR2 on the transformer assembly and, with its associated components, provides the unguarded +5V operating voltage for the logic circuits. The unregulated +5 volt output and its return are sent to the display assembly for use there. Another use for the secondary is 5V XFMR SEC which monitors line frequency. R210, in parallel with U202, provides an increased load capability. Test jumper J201 disconnects the supply, R210, and the load, so that the supply can be checked without a load.

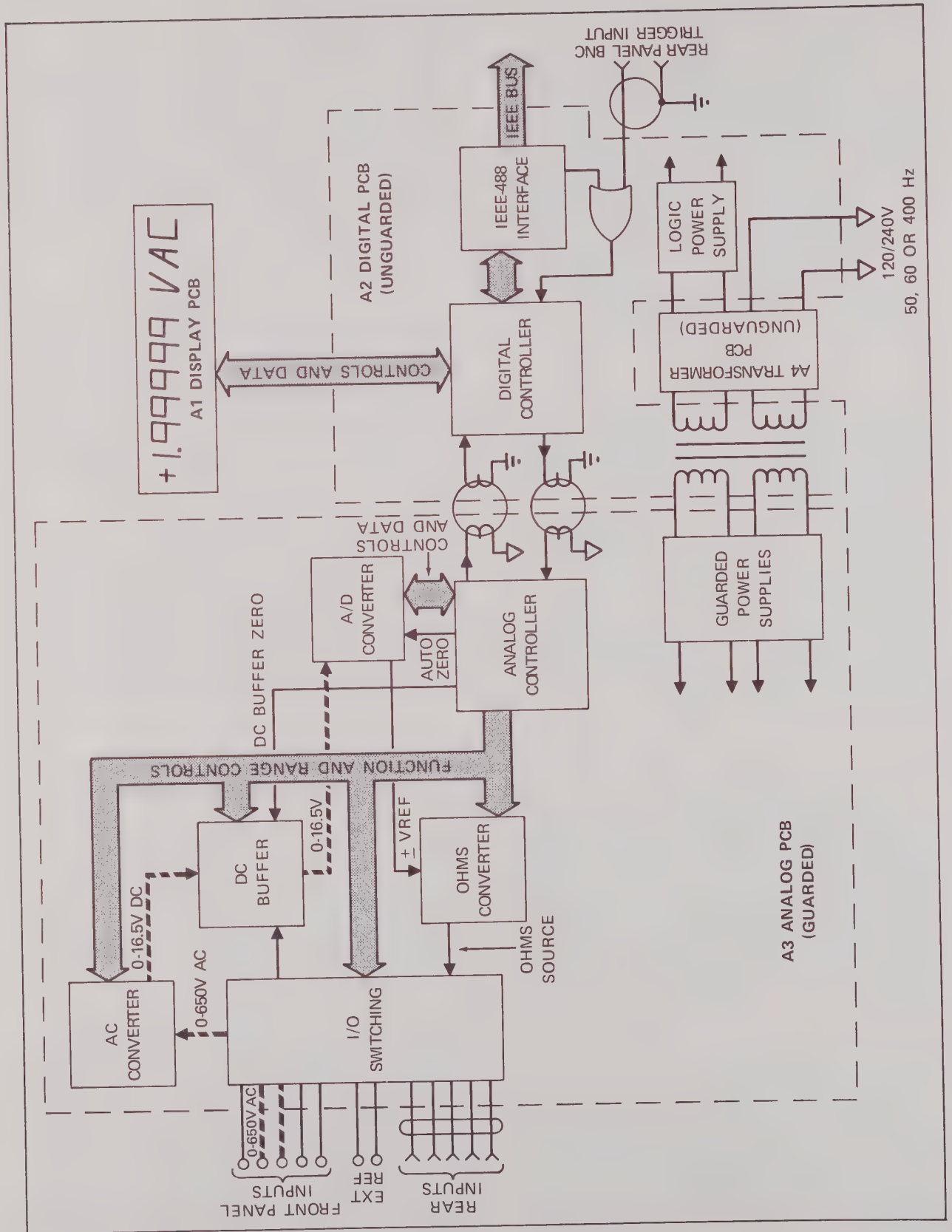


Figure 3-4. AC Volts and AC + DC Volts

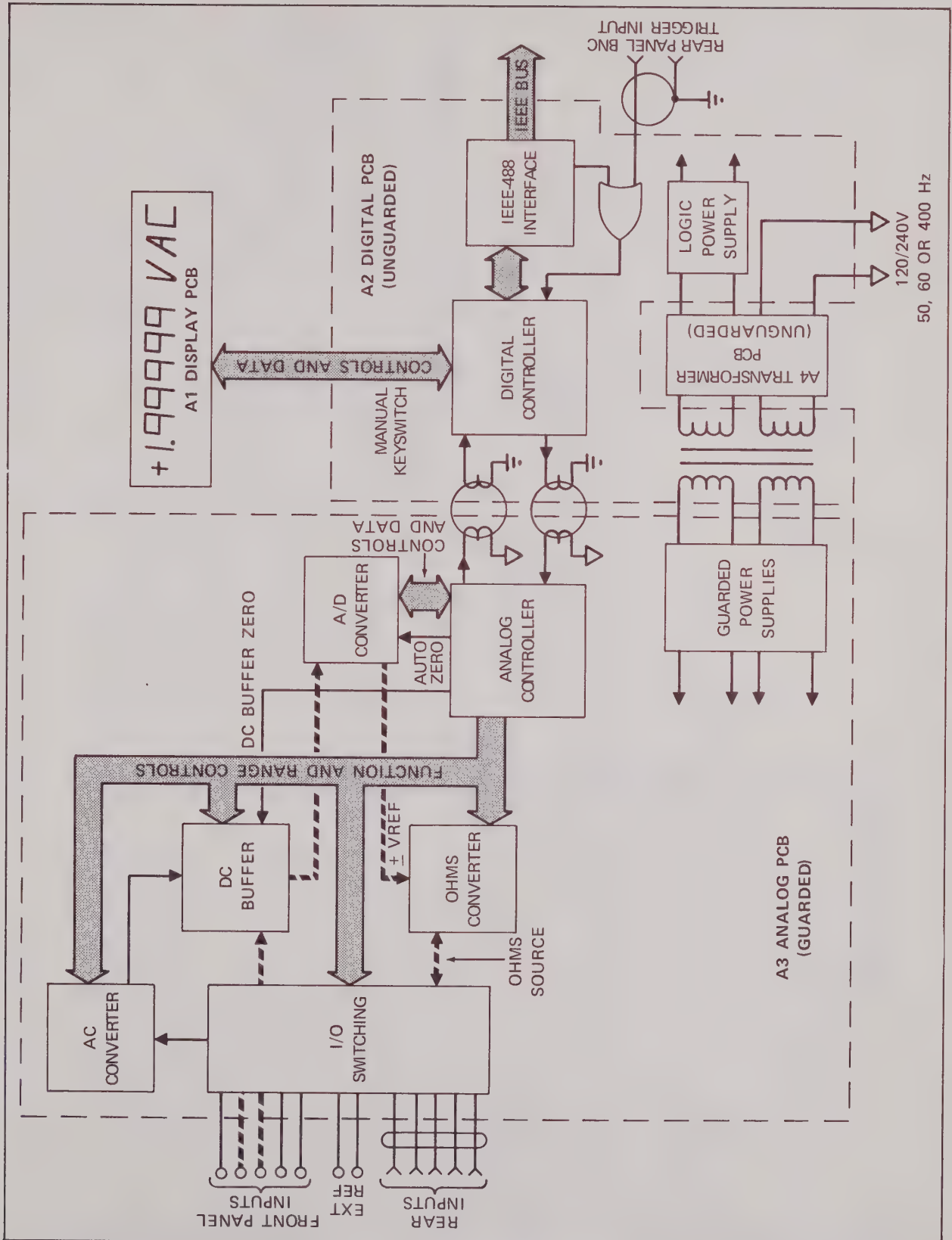


Figure 3-5. Ohms and Nanosiemens

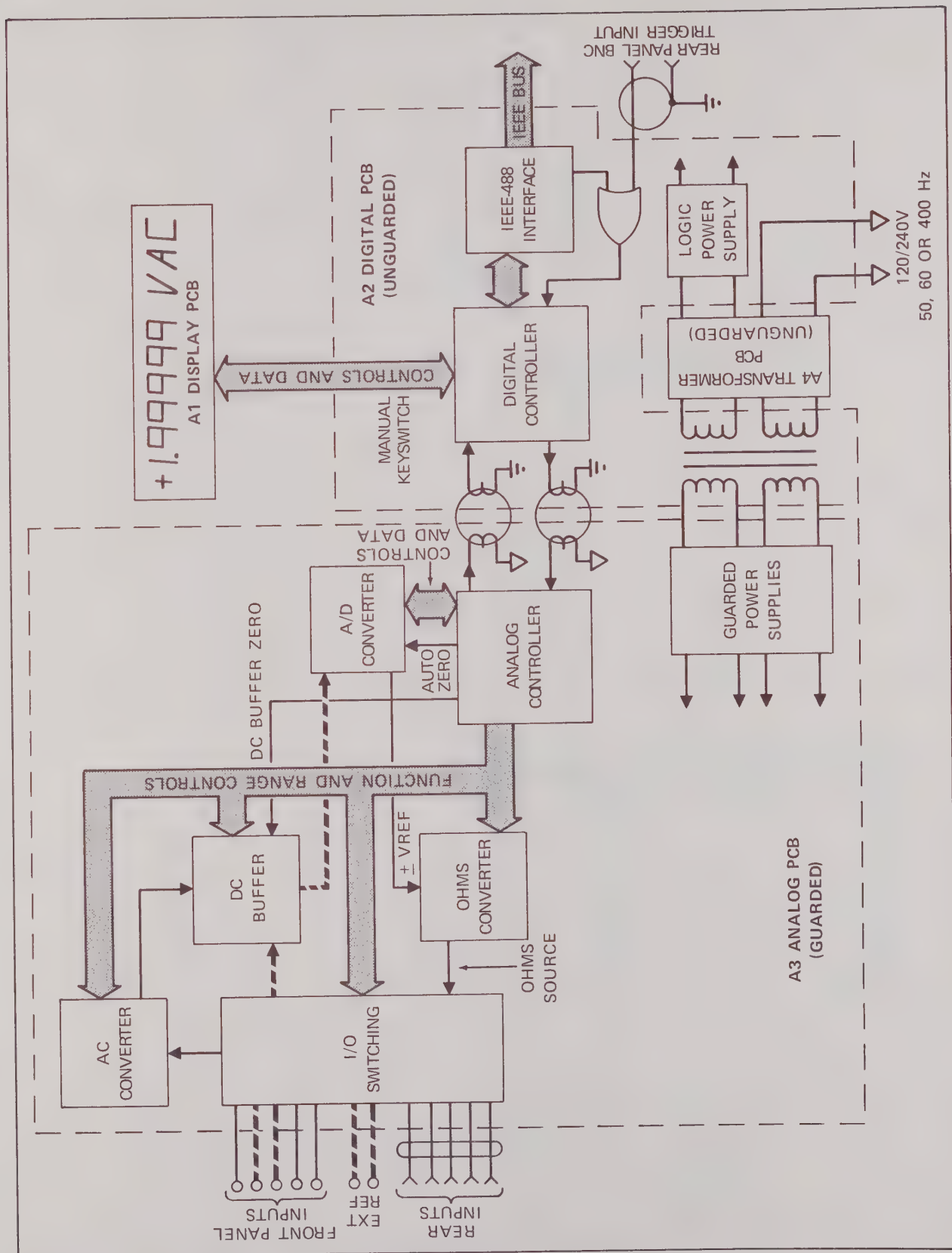


Figure 3-6. External Reference DC Volts

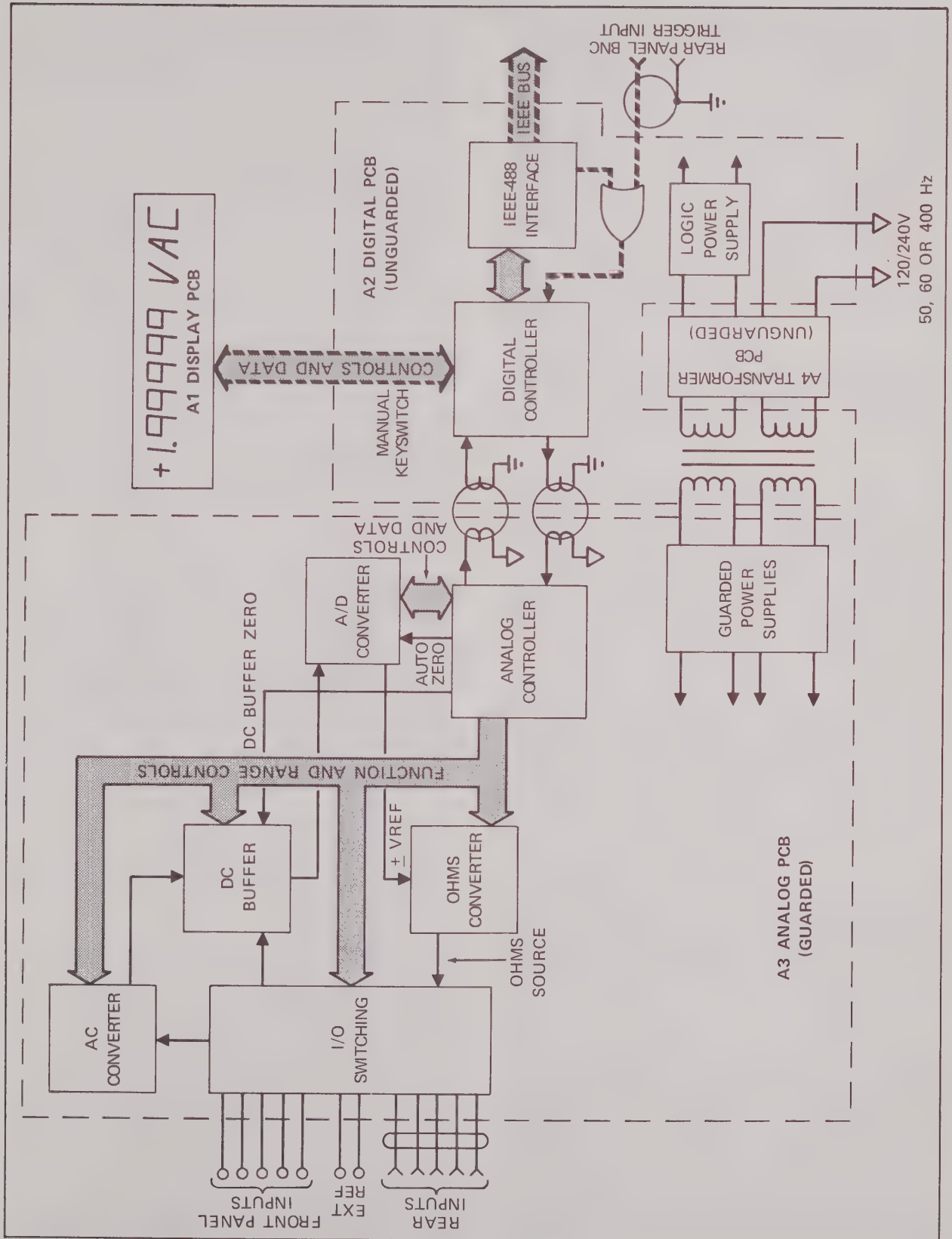


Figure 3-7. External Trigger Inputs

### 3-25. Display Assembly (8520A-1011)

3-26. Segment control data from the controller is placed in U9 and U12 alternately and applied to the display in parallel through the segment drivers (U10/U11 and U23/U24). The driver outputs are multiplexed for the applicable character. The common cathodes of the display are latched into U1 by the Controller with U2 and U3 acting as the digit drivers. One character from the numeric display (7 segment LEDs) and one-half of one character from the alphanumeric display (14 segment LEDs) are addressed simultaneously. The display can be totally blanked with the DISPBLANK signal to prevent damage to the display. DISPBLANK originates on the Digital Controller and is generated if the switch matrix is not read at least once every 16 ms.

3-27. The switch matrix rows and the display are enabled at the same time. Depression of a switch gives a column signal. Decoding the row/column combination in the Controller identifies the depressed switch for the program.

3-28. The normal sequence for a display assembly operation begins with the clearing of U1 to prevent ghosting on the display. Data for the first numeric and one-half alphanumeric characters are then sent to U9 and U12 respectively and the display is turned "on" for 2 ms from U1. The process is repeated, stepping through the eight possible displays and turning "on" each indicator pair in turn at a 60 times per second refresh rate.

### 3-29. Digital Assembly

3-30. The digital assembly is divided into three separate sections. The Digital Controller and IEEE Interface are individually covered in subsequent paragraphs. The third section, the Unguarded power Supply was covered previously as part of the composite Power Supply description.

### 3-31. DIGITAL CONTROLLER (8520A-1021)

3-32. The digital controller section contains the microprocessor, the ROM with the operating program, the RAM for temporary storage and burst memory, and the various control circuits. Each of these circuits is detailed in sub-paragraphs below.

### 3-33. Clock Circuit

3-34. The microprocessor is provided with a 4 MHz square wave by the clock circuit. Crystal Y1 is an 8 MHz oscillator that clocks the standard binary counter, U20. Outputs from the counter in addition to the 4 MHz, are 2 MHz for use in the Guard Crossing circuitry and 1 MHz for use in the IEEE circuitry. The parallel inverters at U19-10 and U19-12, with R6, keep the rise and fall time of the clock within specifications. Ringing is kept withing acceptable levels by R7.

### 3-35. Microprocessor

3-36. The microprocessor is a single component with fully decoded and timed output signals to control standard memory or peripheral circuits. Supply voltage for the device is +5V dc and the only clock required is a single-phase, 5V, 4 MHz square wave.

3-37. The internal register configuration of the microprocessor contains 208 bits of Read/Write memory accessible to the program. The registers include two sets of general purpose accumulator and flag registers that may be used as four 16-bit pairs or as eight 8-bit individuals. Also included is a 16-bit stack pointer that allows implementation of multiple level interrupts and unlimited subroutine nesting. Tabular data manipulation and relocatable code implementation is accomplished with the two 16-bit index registers. The Memory Refresh register provides automatic transparent refresh of external dynamic memories. The interrupt vector register forms the upper 8-bits of a pointer to an interrupt service address table during the interrupt response mode, while the lower 8-bits of the pointer are supplied by the interrupting device. An indirect call is made then to the service address formed. The last register is a 16-bit program counter.

### 3-38. Reset

3-39. The instrument circuitry is automatically reset at power up. When one shot U36-12 is not triggered, it provides U22-13 and 12 with a high and low signal respectively to provide a reset to the controller assembly. Line voltage (FLINE) input from U23-11 (divided by 7 at U32-13 if the line frequency is 400 Hz) triggers U36, releasing the counter U28, which in turn clocks U22 on a count of eight to remove the reset. This places the reset on the circuit for a predetermined time during power up.

3-40. When power is removed, U36-12 times out and sets U22 to apply a reset to the circuitry. Resistor R19 and capacitor C29 provide a timeout for resetting the instrument by shorting test points TP9 and TP10 together.

### 3-41. Wait

3-42. A WAIT signal is input to the microprocessor at U18-24 to indicate that the addressed memory or I/O device needs an extended bus cycle. It can be generated from the IEEE circuit or by U9 as the result of an M1 output from the microprocessor. M1 is active when the microprocessor is performing an op code fetch cycle. The M1 memory access is shorter than all other cycles, in order to provide for the refresh cycle (not used). One WAIT state is added to allow for the access time of the ROMs.

### 3-43. Interrupt

3-44. There are three sources of interrupts. These are: the IEEE circuit, the guard crossing circuit, and the phase

locked loop circuit. The interrupt signals are combined in a wired OR circuit for an input to the microprocessor at U18-16. R26 is a passive pull-up for the line and, in conjunction with C31, filters high frequency chassis noise ( $>10$  MHz) to prevent spurious interrupts. U17-4 in the OR circuit is active (low) from an interrupt from the IEEE. The UART "data available" output is connected to the interrupt line via U33-2, which is enabled at U33-1 from U8-15, and U17-11. Line synchronous interrupts (MARK) are generated by U17-6 each time the phase-locked loop output has a positive transition. The MARK is enabled and cleared by signal MARK EN at U35-1 from U8-19.

### 3-45. Phase-Locked Loop

3-46. Digital noise rejection is accomplished by averaging line synchronous samples. A/D samples are synchronized to the AC line by the phase-locked loop (PLL). The line frequency input (U29-14) is multiplied by 8 by the PLL circuitry U29 and U28. The PLL output (U29-4) which is eight times the input frequency ( $8/7$  for 400 Hz line) provides a clock for MARK interrupts (U35-3), display blanking (U21-1), and the guard crossing trigger flip flop (U1-3).

### 3-47. Guard Crossing

3-48. The Guard Crossing transfers data between the Digital and Analog Controllers using virtually identical circuits on each assembly. On the digital controller it consists of the UART U26, the one-shot U36, the pulse transformer U38, gates from U37 and U30, and their associated components. The UART converts the eight bits of parallel data received on the bus (U26-26 through 33) into a serial data stream, adding parity, start, and stop bits. The 125k baud serial data from U26-25 is inverted (U30-6) to modulate the 2 MHz signal from U20-13. The high voltage driver U37-5 then sends the signal through the pulse transformer U38-3 to the guarded analog controller.

3-49. Modulated 2 MHz data from the analog controller is received by the pulse transformer. The one-shot U36 stretches the 2 MHz bursts into a digital series stream of the original 125k baud rate. The UART converts it to a parallel format and outputs it to the bus on U26-5 through 12.

### 3-50. Memory Select

3-51. The memory for the digital controller consists of two RAMs (four with Option -010), three ROMs, and their control circuits U2 and U3. Address line A15 from the microprocessor enables either RAM or ROM. If it is high, RAM is addressed, if low, ROM. When MEMREQ is low, both RAM and ROM are enabled.

3-52. When RAM is addressed A10, A11, and A12 select either the standard memory (U6 and U7) or the optional memory (U4 and U5) with A10 low and high, respectively.

3-53. One of the three ROMs (U10, U11, and U12) is enabled by U3 from the decoded A13 and A14 signals. U13 and U14 are not installed; their sockets are left open for special applications or future expansion.

### 3-54. Display Blank

3-55. The phase locked-loop clocks U21-1 to count toward eight. If it reaches that count without being reset by the SW signal from U25-8, U21-6 goes high and blanks the front panel display.

### 3-56. Guard Crossing Trigger

3-57. A short pulse is generated in this circuit for the Analog Controller. It is generated at U21-11 and sent through U37-3 to the pulse transformer (U38-6).

3-58. Sources of the trigger are: the external trigger from either the rear panel (U23-2) or the IEEE (U23-1), the MARK trigger U8-6, or the software trigger at U33-13 from the decoded address at U25-10.

### 3-59. External Trigger

3-60. The external trigger edge is selected by the Schmitt trigger circuit at U39. The external clocks U35-11, if enabled by EXT TRIG EN at U35-13 from U8-16.

### 3-61. IEEE-488 INTERFACE (8520A-1022)

3-62. All device interface functions defined by the IEEE-488 1978 Interface Standard are performed within U101. The bidirectional data lines (DI01-DI08) from U108 and U109 are normally three-state drivers; however, when parallel poll is selected they change to open collector. The control lines in U110 are bidirectional under the control of U101. Control lines NRFD, NDAC, and SRQ have open collector outputs; the remaining control lines are three-state.

3-63. The interface is addressed from the digital controller with A7 high and A6 low. A0, A1, and A2 are used to address the internal registers in U101. Switches S103 place the instrument IEEE address on the bus when U102 is enabled from U101. Timing is a 1 MHz clock derived from the Digital Controller 4 MHz clock. The 1 MHz clock is synchronized to the microprocessor I/O access cycle by U103, U104, and U105.

### 3-64. Analog Assembly

3-65. The Analog Assembly is divided into seven separate sections. Six are covered individually in subsequent paragraphs while the seventh, the Guarded Power Supply, was covered previously as part of the composite Power Supply.

### 3-66. I/O SWITCHING (8520A-1031)

3-67. Manual selection of input terminals and guard source, electrical selection of function, routing of signals, filtering, and multiplexing are performed in the I/O Switching section.

3-68. Switch S102 selects between the front panel input terminals and the rear panel connector. When the switch is out, the front panel terminals are connected through the switch to the internal circuitry. If the switch is depressed, the rear panel connector is used. The guard is controlled by S101. If S101 is pressed in, the front panel guard terminal, and therefore anything connected to it, is connected to the internal V guard. When S101 is out, (NORMAL) the V guard is connected through the switch to chassis ground, and the front panel guard terminal is open circuited.

3-69. After selection at S102, the input signal is routed through the contacts of K103. For all functions except low ohms K103 is de-energized, and the signal is routed to other circuits for further direction. In low ohms (K103 energized) the signal is routed directly to the Ohms Converter. K101 is energized in the 2-terminal ohms function to connect the input terminals to the sense terminals.

3-70. AC or AC + DC measurements are routed to the AC Converter through the energized contacts of K104. Relay K102 is energized for the 100 mV and 10V dc ranges, passing through the 150 k $\Omega$  current limiting resistor R110 on its path to the DC Buffer. For the 100V and 1000V ranges, the signal is divided by a factor of 64 in R107. With the high input impedance of the DC Buffer, energizing the relay (K102) does not cause any attenuation.

3-71. High voltage transients in excess of 1.6 kV are clamped by R104 and RV101 through RV104. Thermister R103 and RV105 provide high voltage protection between guard and chassis. The transistors Q101 and Q102, and the diodes CR107 and CR108 limit the input to the multiplexer stage to  $\pm 18.7$  volts.

3-72. Digital signals into the multiplexer stage from the A/D Converter are translated into  $-27V$  for a logic high and "Open" for logic low (by U103, U102, and Q110), to operate the applicable FET switch from Q103 through Q108. An "Open" input to the FET gate turns the switch "on" and allows the applicable input signal to pass through to the DC Buffer section.

### 3-73. DC BUFFER (8520A-1032)

3-74. The DC Buffer section accepts the data input from the I/O Switching section, filters it at the selected speed, and conditions the signal to the proper levels for the A/D Converter. The eventual input to the A/D Converter will be a chopped dc signal, varying between zero and  $\pm 16.5$  volts, and proportional to the input signal.

### 3-75. Filter Circuit

3-76. The filtering stage consists of a fast filter which is a single pole RC network and a slow filter which is a three

pole active filter. The settling time is determined by the filter selected, which also controls the number of samples averaged. The Analog Controller selects the slow filter on power initialization and switches automatically with the reading rate. Table 3-2 gives the settling time, number of samples, and reading rate for each filter.

**Table 3-2. Filter Settings**

| FILTER | SETTLING TIME | NO. OF SAMPLES AVERAGED | READING RATE          |
|--------|---------------|-------------------------|-----------------------|
| Fast   | 5 ms          | 1                       | $\geq 120/\text{sec}$ |
| Fast   | 25 ms         | 4                       | 40-60/sec             |
| Fast   | 50 ms         | 8                       | 20/sec                |
| Fast   | 100 ms        | 16                      | 10/sec                |
| Slow   | 200 ms        | 16                      | 5/sec                 |
| Slow   | 500 ms        | 64                      | 2/sec                 |
| Slow   | 1000 ms       | 128                     | $\leq 1/\text{sec}$   |

### 3-77. Buffer Circuit

3-78. The input to the buffer circuit is a unity gain amplifier (U210 and associated components) which establishes the signal VBOOTSTRAP equal to the input signal. This bootstrap voltage is used in the biasing circuits for the FET switches and in the driving circuit. The automatic zero circuit of FET switches Q231 and Q233 is turned on when a measurement is not being taken. When the switches are turned on, the voltage at the junction of Q231/C230 equals the input ( $V_{in}$ ) plus the offset of U210. The voltage at the junction Q233/C230 equals  $V_{in}$ , plus the offset of U210, plus the offset of U211. As a result, the negative of the offset of U211 is stored on C230, and when a measurement cycle takes place and FET switch Q232 is turned on, the stored voltage cancels the offset of U211. The net offset voltage is zero.

3-79. The driving circuit changes the signal from a  $-15V$  and  $-20V$  logic system into a  $+2V$  and  $-0.5V$  system for the D-MOS FETS. The signal then passes through the non-inverting output amplifier (U211) with its gain determined by the state of the FET switches in its output. The gain will be either unity with Q236 on for the 10V and 1000V ranges, eight with Q237 on for the 1V and 100V ranges, or sixty four with Q238 on for the 100 mV range. The end result is dc voltage output to the A/D Analog section that is between zero and  $\pm 16.5$  volts and proportional to the input.

### 3-80. OHMS CONVERTER (8520A-1033)

3-81. The ohms converter produces a current in the unknown resistance ( $R_x$ ) being measured so that the voltage drop is proportional to the value of  $R_x$ . The method used varies with the magnitude of the resistance.

3-82. If  $R_X$  is  $\leq 19.9999 \text{ k}\Omega$ , it is placed in the feedback loop of an op amp as shown in Figure 3-8. In this configuration, the voltage at the high input terminal should be at or near zero with an infinite input impedance. As a result, all of the current delivered by the reference current ( $I_{REF}$ ) flows through  $R_X$  which can be computed from the output voltage ( $V_O$ ) with the formula  $R_S = V_O / I_{REF}$ .

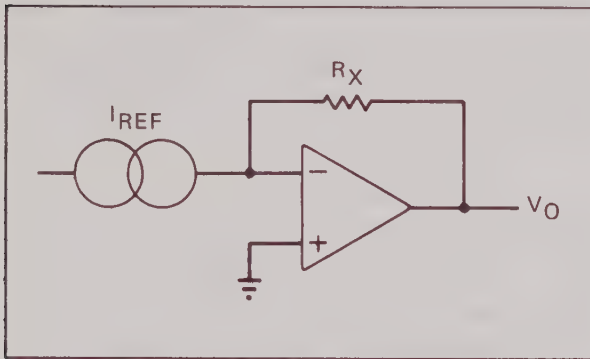


Figure 3-8. Tow Ohms Measurements

3-83. With resistances  $> 20.000 \text{ k}\Omega$ , a voltage reference ( $V_{REF}$ ) is used in lieu of the  $I_{REF}$  as shown in Figure 3-9. With a known reference resistor, the value of  $R_X$  can be computed from the formula  $R_X = R_{REF} (V_O / V_{REF} - V_O)$ .

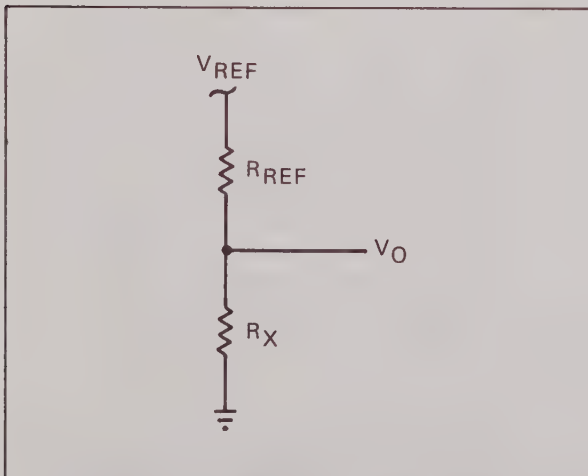


Figure 3-9. High Ohms Measurements

3-84. The output of the ohms amplifier is connected through the I/O Switching section to the DC Buffer and digitized in the A/D Converter. The gain of the DC Buffer varies with the range selected and is 64 for  $10\Omega$ , 1

for  $10 \text{ M}\Omega$ , and  $100 \text{ nS}$ ; and 8 for the remaining ranges. Once amplified and digitized  $R_X$  is computed using the formulas above.

3-85. Measurements of less than 20 kilohms are made using a precision current reference. Measurements of 20 kilohms, or greater, and conductance are made using a voltage reference. Each method is described in further detail below.

### 3-86. Low Ohms

3-87. An accurate reference voltage of  $-6.5\text{V}$  is input to U302 of the current source from the Analog A/D circuit. The 3.077 gain of the inverting op amp places  $+20\text{V}$  at TP304 and on one side of the precision resistor network (R310, R313, R316). When the low ohms function is selected, that portion of the network applicable to the range selected is held at virtual ground so that  $I_{REF} = 20\text{V} / R_{REF}$ . The value of  $I_{REF}$  varies from  $0.1 \text{ mA}$  for the  $10 \text{ k}\Omega$  range to  $1.0 \text{ mA}$  for the  $1000\Omega$  range with K301 energized, to  $10 \text{ mA}$  for the  $100$  and  $10\Omega$  ranges with K302 energized. On the three lowest ranges, the relay contact resistance, when taken with the lead resistance, could have a significant effect on  $I_{REF}$ . This error is counteracted by the feedback paths through Q305 for the  $10$  and  $100\Omega$  ranges and through Q302 for the  $1000\Omega$  range. This constitutes a Howland Current Source which theoretically offers infinite output resistance.

### 3-88. High Ohms

3-89. Resistances  $\geq 20 \text{ k}\Omega$  and conductance measurements are made using a reference resistance and  $V_{REF}$  of  $6.5 \text{ volts}$ . The voltage reference is sampled, and the reading stored by the I/O Switching section. This ensures that long term variations are removed whenever a high ohms range is selected. The reference resistance is  $450 \text{ k}\Omega$  (R321 and R315) with K303 energized for the  $100 \text{ k}\Omega$  range. For the  $1\text{M}$ ,  $10\text{M}$ , and  $100 \text{ nS}$  ranges, K303 is de-energized to add R319 and R320 to the circuit and provide a reference of  $4.5 \text{ M}\Omega$ . Relay K304 is energized for all high ohms ranges.

### 3-90. Input Ohms Amplifier

3-91. The input ohms amplifier has a bi-polar differential input stage (Q309), an op amp (U303) and a large current sink capability with high voltage protection in the transistor array U301. The output is also protected by the positive temperature coefficient thermistor R101 and the zenor diode CR105 in the I/O Switching section.

3-92. The input stage is protected by current limiting resistor R332, plus Q310 and Q311. If the input terminals are left open in low ohms, Q317, and the divider R113 (I/O Switching section), and R343 clamp the output voltage to less than  $8 \text{ volts}$ . It also opens the feedback path to the ohms amplifier. For a standby function, a feedback path is provided through a turned on Q308.

### 3-93. AC CONVERTER (8520A-1034)

3-94. The 8520A AC Converter is a true RMS Converter. It mathematically obtains the conversion by ranging the input to 1 volt full-scale signal, averaging the square value of the signal, and then taking the square root of the averaged squared signal.

3-95. The converter accepts signals from the input terminals and converts the signal to a dc level proportionate to the RMS value of the input. The dc output signal will be between zero volts and plus sixteen volts (full scale reading). The signal is routed through five stages, which are: the ranging amplifier, balance amplifier, squaring amplifier, square root amplifier, and integrator/filter.

3-96. The range and balance amplifiers operate independently, but the remaining three work in conjunction with each other. The range amp brings the input signal within the 1V rms range. The balance amp converts the signal to a dc absolute value. The conversion to rms is performed by the squaring amp, integrator, and square root amp, using a double logarithmic response, i.e.,  $2 \log X = \log X^2$ .

### 3-97. Range Amplifier

3-98. The range amplifier is an inverting amplifier with four user selectable ranges. They are, at full scale, 2, 16, 128, and 1024 volts (limited to 650V rms or 1000V peak for safety). The three higher ranges are multiples of eight ( $2^3$ ) for simpler microprocessor implementation in ranging. A full scale output of the range amp is 1 volt.

3-99. Either AC or AC plus DC can be accepted in the range amp. C401 normally blocks dc. However, if the AC + DC function is selected, K401 is energized to bypass the capacitor. FET switches Q401 through Q409, and Q421 are turned on by the Analog Controller in the sequence shown in the chart on the schematic diagram.

3-100. Using the 100V range as an example, the schematic chart shows that FETs Q403, Q404, and Q421 are enabled, and the remaining Range Amplifier FETs are disabled. Q403 and Q404 are enabled to route the input signal through the 100V attenuation circuit prior to application to U401. Q421 is enabled to ground out any stray capacitance from the 10V range.

3-101. Amplifier U401 uses both feedback and summing node shunt capacitance to provide for stable operation as an adjustment of high frequency gain. The stray capacitance of the FET switches also provides stability to the amplifier on the 1 volt range. Failure of one of the stabilizing capacitors could result in oscillation within that range.

3-102. All dc adjustments of the Range Amplifier are normalized to the 1 volt range adjustment (R487). The frequency adjustments and capacitive adjustments are normalized to the 1000 volts range adjustment (R438).

### 3-103. Balance Amplifier

3-104. The balance amp is a precision halfwave rectifier in an inverting unity-gain configuration. It consists of U402 for the gain, and the dual transistor transconductance drivers Q410 and Q411 for fast switching of the rectifier diodes. The current is forced through the hot carrier diodes CR405 or CR406 and through either R454 or R456, as determined by the polarity of the signal. The output of the balance amplifier can be viewed at TP403.

### 3-105. Squaring Amplifier

3-106. Outputs of the range amp and balance amp are summed at the input of the squaring amp (U403). The op amp output (J419) represents twice the natural logarithm of the summed current input. The squaring is accomplished using the forward biased PN junctions of a transistor (Q414A, Q415B) and the inverse result from Q415A, as controlled by the output of the Square Root amplifier. Q414 and Q415 are dual transistors designed to provide logarithmic conformity and good frequency characteristics. They are placed in the circuit so their offsets cancel, allowing a tighter gain adjustment with R481. High frequency stabilization between 300 kHz and 1 MHz is provided by R468 and C455.

### 3-107. Integrator/Filter

3-108. The integrator is a transfer impedance amplifier (U404) which produces a voltage at its output (J420) for a current input. The output of the squaring amp is acted on by the Integrator/Filter and Square Root amplifier to produce a dc voltage that is the RMS value of the signal at the input. The circuit has two selectable filters of 100/200 ms (fast) and 500/1000 ms (slow). The filters are switched on and off with the FET switches, Q416 through Q419. The slow filter is switched in with Q416 and Q417, and the fast filter is switched in with Q418 and Q419. The filter is a three-pole filter with the FET switches shifting the poles lower in frequency (slow) or higher (fast).

### 3-109. Square Root Amplifier

3-110. The square root amp (U405) operates in conjunction with the integrator in performing the square root function. The squaring amp provides the current drive for Q415A, which is the current source for the integrator. The square root amp is in the feedback loop of the integrator. Any signal at the output of the integrator affects both the square root amplifier and the integrator. The output voltage of the square root amp (TP404) is the natural logarithm of the current through R483.

3-111. Stability for the overall loop is provided by C446. Diode CR408 and R482 prevent the circuit, i.e., square root amp and integrator, from latching.

### 3-112. Feedforward Temperature Compensation (FTC) Circuit

3-113. The FTC circuit (U408) is not in the signal path for the ac measurement. It is used to correct for dc drift in the balance (U402) and squaring (U403) amplifiers. The result is the excellent high frequency performance of the ac converter while maintaining dc performance.

### 3-114. A/D CONVERTER (8520A-1035)

3-115. The A/D Converter uses Fluke's patented Recirculating Remainder ( $R^2$ ) method of converting a dc input signal into a binary, byte-serial, data stream. Operation of the A/D Converter is controlled by the microprocessor in the Analog Controller. The converter consists of five sections, which are: the reference circuit, the polarity detector, the automatic zero, the current ladder, and the X and Y remainders. A sample is generated when five passes through the ladder network have been executed, resulting in 21 bits of binary data. It requires 1.77 ms to complete the five passes (one sample) in the high speed mode.

3-116. The Reference circuit (U501, U502, U503, and associated components) provides a 6.5 volt reference to the current ladder. The reference varies in polarity as the inverse of the input. In some units U501 is replaced with a Ref Amp PCB Assembly (schematic 8520A-1045 or 8520A-1046) that plugs into the Analog Assembly in place of U501. Operation of the ref amp circuit is identical to the discrete component U501, and either may be used as a replacement.

3-117. The first step in the sample process is the autozero. The Analog Controller command makes "AZ" active on the gates of FET switches Q528 and Q529 to zero the circuit in preparation for a new input. When auto zero is complete, the Controller makes "G" and then "I" active to close FET switches Q529 and Q512, respectively. This allows the input to enter U506, which acts as a polarity detector.

3-118. The Reference circuit is assigned the opposite polarity from the input, based on a polarity decision made by the Analog Controller. The correct polarity reference voltage is applied to the current ladder. Each branch of the current ladder has twice the resistance of the succeeding branch, corresponding to the binary digits 8, 4, 2, 1, and 0.5. The microprocessor closes the FET switches in the ladder, one at a time, starting with Q521 as a pass is made through the ladder. If there is excess current from the ladder, it will flow in CR505. The FET switch remains closed, and the excess current is tried on the next switch in succession. If there is no excess current, or there is a current debt, current flows through CR506

and causes a polarity change in the ladder. The polarity change causes the Controller to re-open the FET switch and try the next switch in succession. The same process is repeated on the four remaining FET switches to complete the first pass. In most cases there is current remaining after the pass. Switch Q529 opens when the pass is complete and switch Q526 is closed by the controller to store the remainder in the "X" channel.

3-119. The remainder current flows in the loop around U505 where there is a voltage gain of 10, and is stored in C506 when switches Q526 and Q531 are closed by the Analog Controller. Once the remainder is stored, the Controller opens Q512, Q526, and Q531 and closes Q529 and Q525. This returns the current to the ladder with a current gain of 16, in comparison to the original remainder, which is required to continue the 8, 4, 2, 1, 0.5 conversion. Thus, an "error" of 0.5 on the first pass becomes an input of "8" on the next pass.

3-120. The procedure for a pass through the ladder is then repeated, substituting the "Y" channel for the "X" When the pass through the ladder is completed, Q524 and Q530 are closed for the gain in U504, and C505 stores the remainder. Then Q512, Q524, and Q530 open and Q523 closes to retrieve the remainder for another pass. The retrieve "X" switch, Q525, remains closed until Q524 and Q530 close to store the "Y" remainder.

3-121. The process alternates between the "X" and "Y" channels until the five passes through the ladder are complete. Each pass overlaps by one bit, to allow for correction of the bit switch closures that are in error. The analog controller then correlates the data into a three byte word, sends the sample for display, and prepares the circuit for the next sample.

3-122. An example using a DC Buffer output of -10.2 volts follows. The circuit is autozeroed, Q529 closes, then Q512 closes, and the reference voltage is set at +6.5 volts. Q521 turns on, and remains on. When the Controller closes Q519, a polarity change occurs, and the switch must be reopened. When Q517 is closed, it remains on. Like Q519, Q515 and Q513 are reopened. Thus, the "8" and "2" bits are on. The first pass ends, and there is a remainder of -0.2 volts which is stored in the "X" channel as a voltage of +2.0 volts. It is retrieved with a net gain of sixteen to appear equivalent to an input of -3.2 volts, and the process is repeated. This time only Q517 and Q515 remain closed, and there is again a remainder of -0.2 to be stored in the "Y" channel. The process is repeated three more times. However, the passes will be identical to the second, other than alternating storage channels.

3-123. To review the process, it begins with an autozero followed by setting the reference voltage. The next step is the first pass through the ladder. The remainder is amplified and stored and then sent through the ladder.

This is repeated for five passes and then the sample is sent to be displayed, and the cycle begins again for another sample.

### 3-124. ANALOG CONTROLLER (8520A-1036)

3-125. Range and function information from the Digital Controller is accepted by the Analog Controller, interpreted, and output to circuits on the Analog PCB. Some signals for the measuring circuits originate with the microcomputer in the Analog Controller. Each of the circuits within the Analog Controller are detailed below.

### 3-126. Guard Crossing Circuit

3-127. Data from the Digital Controller enters the circuit in serial form at pulse transformer U627. The resultant output fires the "single shot" U609 for a serial input to the UART U602. The data is processed, and output, as parallel data, to the controller bus.

3-128. Data originating in the Analog Controller is transmitted on the bus, in parallel to U603. Then it is translated to bit-serial format and output through U610 and U627 to the crossing and the Digital Controller.

### 3-129. Microcomputer

3-130. The microcomputer is a mask programmed one-chip microprocessor, complete with its integral RAM and ROM. Under the control of the program, as modified by interrupts from the digital controller, the microcomputer outputs data to the I/O circuits and the data bus.

3-131. Switch S601 is not installed in the circuit. An 8-pin dip socket is available to insert a four-pole dip switch, if desired, for use during troubleshooting. Jumpers may also be used to short across the socket pins when required. Switch 1 would be the two pins toward the front of the instrument if this method is used.

### 3-132. I/O Circuits

3-133. Data on the bus is latched in U603 and decoded in U604 to provide control signals to the UART U602 or a

strobe to one of the following latches or buffers: U607-9, U608-4, U611-1, 15, U612-1, U617-9, U618-11, U619-11, U620-11, and U621-11. Data from the bus is latched into or strobed through the applicable latch or buffer to transmit a command to another circuit or place data on the bus for the microcomputer.

### 3-134. Interrupt Circuit

3-135. Data on the bus (DB0-DB5) is latched into U607 on the decoded signal from the I/O circuit. A signal at U607-12 and U607-15 are ANDed with TBE and DAV, from the UART, respectively to generate an interrupt at wired OR U615 and at U601-6. The remaining signals at U607 provide enabling signals to monitor the UART S1 and EPE signals, the microcomputer T0 signal, and the trigger circuit.

### 3-136. Trigger Circuit

3-137. Guard crossing transformer U627 (pins 6, 8, 9, and 11) is bidirectional and receives trigger strobes from the Digital Controller. The interrupt circuit controls the output of the trigger at U608-9 to insure that a trigger interrupt does not interfere with a reading in progress. U608-13 is held low from U607-10 in the interrupt circuit to disable the latch when a reading is in progress. When the reading is complete, U607-10 goes high, enabling the latch to await the next trigger.

### 3-138. Reset Circuit

3-139. A reset signal is sent to the microcomputer from the Reset Circuit any time that power is applied or lost. Line voltage triggers the retriggeable one shot U609. The one-shot output, in conjunction with a low output at U605-4, enables the counter U605 and allow the line voltage to pulse the counter. When the count sets U605-4 high, the counter is disabled and stays that way until the one-shot U609 is not triggered. Removal of the constantly recurring pulses reset the counter, and the low going output resets U607 and gives a RESET signal to the microcomputer.

## Section 4

# Instrument Assembly/ Disassembly

### 4-1. INTRODUCTION

4-2. Each of the following procedures deals with the removal/replacement of a single item or feature from the instrument. They are listed in a disassembly sequence, however, all previous steps may not be required to obtain access to the desired part/assembly of the instrument. Reassembly can be accomplished by performing the steps of the applicable procedure in a logically reversed sequence.

### 4-3. TOP/BOTTOM COVER

4-4. Removal and replacement of both the top and bottom covers is accomplished in the same manner once the desired cover has been placed toward the operator for ready access.

1. Remove the three screws across the front edge of the cover.
2. Remove the three screws across the rear edge of the cover.
3. Lift the cover straight up, guiding it out of the grooves in the front and rear panels.

### 4-5. TOP ANALOG GUARD COVERS

4-6. The analog section has a top guard cover with access ports for the calibration adjustments. The top cover must be removed to gain access to the instrument compartment prior to beginning the procedure.

1. Remove the screws securing the top guard cover to the internal guard chassis.
2. Remove the side screws, one centered on each side, through the access ports.
3. Lift the rear end of the top guard straight up, then remove it from the instrument compartment

by moving it toward the rear to clear the lip on the front of the compartment.

### 4-7. INTERNAL GUARD COVERS

4-8. The analog assembly has two internal guard covers. One is located over a portion of the AC Converter, and the other over part of the DC Buffer. In both cases, the top cover and the top analog guard cover must be removed to gain access to the internal guards. Separate procedures are given for removing each of the guard covers.

### 4-9. DC Buffer Guard

1. Press upward on the side of guard at the front right corner until it releases from the studs.
2. Lift the guard up and toward the center of the instrument to clear the wiring harness along the side of the guard.

### 4-10. AC Converter Guard

1. Press upward on the side of the guard at the front left corner until it releases from the studs.
2. Lift the guard up and away from the enclosed components.

### 4-11. FRONT PANEL DISPLAY ASSEMBLY

4-12. The Front Panel must be removed to gain access to the Display Assembly and its components. To reach screws required for removal, the top cover must be removed. Removal of the top analog guard cover is not required but removal does improve access to the screw heads.

1. Remove the two screws located on the rear upper corners, attaching the front panel to the frame.

2. Using both hands, squeeze the top and bottom of the panel together to clear the tabs holding the panel in place.
3. Once the panel is clear of the tabs, move the panel forward to clear the tabs.
4. Remove the wires connecting the front panel input connectors to the Analog Assembly using a pair of needle-nose pliers.

#### NOTE

*To facilitate the replacing of wires on terminals during assembly, the color code is molded into the panel next to each terminal.*

5. Disconnect the ribbon cable connecting the Display Assembly to J11 on the Digital Assembly.
6. Remove the four screws securing the Display Assembly to the frame and lift the assembly clear of the instrument.

### 4-13. ANALOG ASSEMBLY

4-14. Remove the Analog Assembly from the instrument compartment using the following procedure. Prior to starting, the top cover, the top analog guard cover, and either the front panel or the five wires to the front panel input terminals must be removed.

1. Disconnect the ribbon cable connecting the Analog Assembly to the Digital Assembly.
2. Loosen the four retaining screws and remove the cover from the transformer and Transformer Assembly.
3. Disconnect the cable connecting the transformer to the Analog Assembly and take it back through the slot in the transformer compartment.
4. Remove the two screws attaching the rear input connector to the rear panel, then push the connector through the rear panel into the instrument compartment.
5. Remove the 11 screws securing the assembly to the instrument frame. Six of the screws are through the PCB to the bottom guard, and the other five fasten the hardware attached to the rear of the assembly to the rear panel.
6. Lift the rear of the assembly and move it out toward the rear of the instrument, exercising caution to prevent damage to the GUARD and

REAR INPUT switches that are attached to the front of the assembly.

### 4-15. TRANSFORMER AND TRANSFORMER ASSEMBLY

4-16. Remove the transformer and Transformer Assembly from the instrument compartment using the following procedure. Prior to starting, the top cover and the top analog guard cover must be removed from the instrument.

1. Loosen the four retaining screws and remove the cover from the transformer.
2. Disconnect the cable connecting the transformer and Analog Assembly from the Analog Assembly and bring the cable back through the center divider into the transformer compartment.
3. Remove the cable clamp from the transformer compartment frame.
4. Remove the eight screws attaching the transformer compartment to the frame. Four are used on the outside frame and four on the center frame.
5. Lift the transformer compartment containing the transformer and Transformer Assembly straight up and out of the instrument compartment.

### 4-17. DIGITAL ASSEMBLY

4-18. Remove the Digital Assembly from the instrument compartment using the following procedure. Prior to starting, the top cover, the transformer, and the Transformer Assembly must be removed from the instrument.

1. Disconnect one end of the guard crossing ribbon cable connecting the Analog and Digital Assemblies, and bring the cable through the slot in the center guard and frame.
2. Remove the three screws holding C201 to the outside frame.
3. Remove the three hex-head bolts and nuts securing the IEEE connector to the rear panel.
4. Disconnect the three input line-power wires from the lugs on the assembly.
5. Turn the instrument over, and remove the bottom cover from the instrument if not previously done.

6. Remove the five screws securing the Digital Assembly PCB to the tabs in the instrument compartment.
7. Lift up the front of the assembly and slide the PCB forward and out of the instrument compartment.

#### **4-19. BOTTOM ANALOG SHIELD**

4-20. Once all other assemblies have been removed from the instrument compartment, the bottom portion of the analog guard can be removed by taking out the three screws from the outside frame and the three from the center frame. Since this item is hardware with no active components, removal is seldom necessary.



## Section 5

# Troubleshooting

### 5-1. INTRODUCTION

5-2. Troubleshooting for the 8520A is contained in Tables 5-1 through 5-9, Figures 5-1 through 5-7, and in the following paragraphs. These tables are tabular flow charts that direct you to another step, as determined by the response to a decision step. If no decision is required perform the next step of the table in sequence.

5-3. The troubleshooting tables are built around the self tests incorporated into the software. However, the tables assume there is some response when the POWER switch is depressed by the Operator. If there is no response from the instrument use the Power On Procedure below before proceeding. If there is a response it may be an Error Code (the display shows "Err XX" with the "XX" representing a two character display). A list of these Error Codes and a brief explanation of each is given in Table 5-4. The tables cover procedures for troubleshooting the Front Panel, the Digital PCB, and the Analog PCB. Until you accumulate sufficient experience you should progress through the tables in sequence. You will either skip rapidly through the table or be referred to another table if the problem is not with the circuit covered.

### 5-4. POWER ON PROCEDURE

5-5. If the instrument does not respond to the power on command check the power supply test points (TP7XX on the analog pcb and TP201 on the Digital PCB) for the correct voltages as shown on Table 5-5, Typical Voltages and Waveforms. If all voltages are correct, continue with the Front Panel Troubleshooting, Table 5-1.

5-6. If all of the voltage tests are out of tolerance or absent, check the transformer primary inputs, i.e. the line cord, the fuse, the thermal fuse, the voltage selector switches and their settings, the line voltage outlet, the POWER switch, and the connectors to the Transformer PCB. If all of these are good check the transformer itself.

5-7. If part of the voltage tests are within tolerance check the secondaries and/or rectifier circuits for the failed tests. The Digital PCB Power Supply has an

adjustment and J201 can be removed to prevent any loading from the digital circuits. There are no adjustments on the Analog PCB Power Supply; however most of the circuits have jumper plugs that can be removed to insure the test does not fail due to loading by the circuits. Remove J19 from the Analog PCB to disable the DC Buffer and I/O Switching circuits, J20 for the Ohms Converter, J21 for the AC Converter, and J22 for the Analog Controller.

### 5-8. SPECIAL PROCEDURES

5-9. Special procedures are provided for testing the Analog Controller and A/D Converter circuits. The procedures are called out in the Analog PCB Troubleshooting tables when required.

### 5-10. Analog Controller Tests

5-11. Three test programs are available in the Analog controller microprocessor to test the digital functions of the Analog PCB. These tests may be an aid in troubleshooting the Analog Controller if the instrument consistently displays an error message, fails all steps of Math Program 1 Test #1 (the power supply outputs should be checked first), or consistently reads gross errors during measurements. Prior to beginning the microprocessor tests, the presence of the signals described in the first sub-paragraph below should be verified. An 8-pin dip switch must be installed in the empty S601 socket, next to the analog controller microprocessor, before any of the tests can be selected. In addition, the instrument input terminals must be "open" and the guard crossing cable disconnected. These conditions cause a front panel error display, which should be ignored during these tests. When the instrument operates as a voltmeter, the microprocessor does not check the status of S601; however, if TP607 is shorted to TP608, it resets the analog controller microprocessor and the switch status is "read". When the tests are completed, return the instrument to voltmeter operation by setting all of the switches on S601

to OFF, reconnecting the guard crossing cable, and shorting TP607 to TP608, which forces the microprocessor to check the status of S601. The selection method and operation of each of these tests are described below.

## 5-12. ANALOG CONTROLLER INPUT SIGNALS

5-13. Verify the presence of the following signals before testing the Analog Controller microprocessor:

1. Readings of -15V dc at TP603 and -20V dc at TP604 for a +5V dc logic signal.
2. A line frequency square wave at U614-4.
3. A 2 MHz square wave clock at TP605.
4. A pulse (ALE) approximately every 12.5 msec at TP602 (variable with the input line frequency).
5. A logic high reading (INT) at TP606.
6. A logic high that goes low at TP601 (RESET) when TP607 is shorted to TP608, and returns high approximately 400 ms (60 ms for a 400 Hz line frequency) after the short is removed.

## 5-14. LATCH TEST

5-15. This test applies a continuous circulating signal to a component selected by the S601 test switch. The microprocessor checks the status of S601 constantly during the Latch Test to determine which component receives the signal. The output of the selected component can be monitored with an oscilloscope or logic probe. Use the following procedure to perform the latch test:

1. Insure S601 is installed and the guard crossing cable is disconnected.
2. Set switch #1 of S601 to ON and the remaining switches to OFF.
3. Short TP607 to TP608 to reset the Analog Controller.
4. Select the component to be exercised by setting S601 to the position indicated in Table 5-10.
5. Observe the output pins of the selected component for a recurring pulse.

### NOTE

*An oscilloscope setting of 5 volt/div and 50 us/div should give a display of the recurring pulse.*

6. Set the switches on S601 for either the next test or all OFF (to resume voltmeter operations), then short TP607 to TP608 to reset the Analog Controller and make it "read" the switch setting.

## 5-16. UART TEST

5-17. The UART test checks the response from the transmitted data. Before each test a byte of data is written

into Port 1 (U601-27 through 34). An incorrect response stops the test and the failed step can be determined by reading the data byte in Port 1. If the test fails, all of the data bits in the port are at a constant state. If the test passes the test is continuously repeated and the three low order bits are changing states constantly. Use the following procedure to perform the UART test:

1. Insure S601 is installed and the guard crossing cable is disconnected.
2. Set switch #2 on S601 to ON and the remaining switches to OFF.
3. Short TP607 to TP608 to reset the Analog Controller.
4. Monitor the status of Port 1 for a constant level, i.e. either always high or always low, on all eight bits of the port.
5. If the three low order bits (U601-29,28,27) are constantly changing states the instrument passes the test. If all eight bits are at a constant level the controller is locked on the failed test and the missing signal can be identified by decoding the three bits using Table 5-11. Once the missing signal has been identified refer to the UART and Interrupt Troubleshooting Procedures paragraph that follows the Interrupt Test.
6. Set the switches S601 for either the next test or all OFF (to resume voltmeter operations), then short TP607 to TP608 to reset the Analog Controller and force it to "read" the switch setting.

## 5-18. INTERRUPT TEST

5-19. The Analog Controller microprocessor generates a DAV and an external trigger interrupt for use within the instrument. They are tested in a series of six steps, with a byte of data written into Port 1 (U601-27 through 34) at the beginning of each step. If the step fails the byte is locked into Port 1 and it can be decoded to determine the failed step. If the test passes it is continuously repeated and the four low order bits are constantly changing states. Use the following procedure to perform the interrupt test:

1. Insure S601 is installed and the guard crossing cable is disconnected.
2. Set switch #4 of S601 to ON and the remaining switches to OFF.
3. Short TP607 to TP608 to reset the Analog Controller.
4. Monitor the status of Port 1 for a constant level, i.e. either always high or always low, on all eight bits of the port.
5. If the four low order bits (U601-30,29,28,27) are at changing level the instrument passes the test. If all eight bits are at a constant level the controller is locked on the failed test and the missing signal can

be identified by decoding the four bits using table 5-12. Once the missing signal has been identified refer to the UART and Interrupt Troubleshooting Procedures paragraph that follows this test.

6. Set the switches on S601 for either the next test or all OFF (to resume voltmeter operations), then short TP607 to TP608 to reset the Analog Controller and force it to "read" the switch setting.

## 5-20. UART AND INTERRUPT TROUBLESHOOTING PROCEDURES

5-21. Once the missing signal has been identified the tests in Table 5-13 can be used to locate the defective component(s). The table lists only the pertinent IC's; however, associated components should be checked at the same time. Check for missing components, improper values, defective components, shorted inputs or outputs, bent legs that could produce capacitive coupling (CMOS) or thermal problems, shorted bus lines, or lines shorted to logic common or logic ground. Repair or replace the defective component(s) when located then repeat the test during which the fault was found.

## 5-22. A/D Converter Test

5-23. The A/D Converter test permits the examination of the A/D ladder during a conversion. A known voltage is applied to the terminals and the output monitored for a waveform that can be translated to a digital number corresponding to the most significant digit of the input. Use the following procedure to perform the A/D Converter test:

1. Prepare the instrument for normal operation. Select Volts DC and fix the range at 10 Volts.

2. Apply a known input  $>0$  and  $<0.2$  volts from a variable source to the input terminals.

3. Using a dual trace oscilloscope connect one trace to TP509 for sync and observe the waveform at TP508 with the other.

4. The waveform at TP508 can be decoded to the digital value of the most significant digit. It represents values of 8, 4, 2, 1, and 0.5. In this case all should be high, as shown for 0 volts in Figure 5-8.

5. Vary the source to a known input  $>1.0$  and  $<1.2$  volts.

### NOTE

*The input must be read by the 8520A as  $>1$  to insure data in the one bit but  $<1.5$  (approximately) to keep data from the 0.5 bit. An input of 1.1 volts insures the correct digital value.*

6. The waveform at TP508 changes to that shown in Figure 5-8 for 1 volt.

7. Rotate the source through the remaining voltages in Figure 5-8. Insure the input is greater than the basic so the tolerance of the instrument does not put the input below the basic value.

8. Verify the waveform representing the digital count at TP508 is correct for each input voltage.

9. If the waveform is incorrect for any input check that portion of the ladder.

Table 5-1. Front Panel PCB Troubleshooting

| STEP NO. | ACTION                                                                                             | GO TO STEP FOR CORRECT RESPONSE |    |
|----------|----------------------------------------------------------------------------------------------------|---------------------------------|----|
|          |                                                                                                    | YES                             | NO |
|          | NOTE                                                                                               |                                 |    |
|          | <i>All tests are made in relation to <math>\nabla</math> at TP6 unless otherwise noted.</i>        |                                 |    |
| 1        | Disconnect the instrument from any external controller.                                            |                                 |    |
| 2        | Depress the POWER switch to apply power to the instrument.                                         |                                 |    |
| 3        | Does any portion of the Display or any indicator illuminate?                                       | 17                              | 4  |
| 4        | Is VUNREG present at TP7 ( $\approx 8V$ )?                                                         | 5                               | 15 |
| 5        | Are there recurring strobe pulses at U7-11?                                                        | 7                               | 6  |
| 6        | Check U7 and its inputs from the digital PCB. Replace or repair as required then resume at step 3. |                                 |    |
| 7        | Is there approximately 4.1V present at TP4. (VUNREG less the 3.9V drop of Zener CR1.)              | 9                               | 8  |
| 8        | Check Zener diode CR1 and R2. Repair as required then resume at Step 3.                            |                                 |    |
| 9        | Is U1-1 High?                                                                                      | 10                              | 15 |
| 10       | Does U1-11 toggle?                                                                                 | 11                              | 15 |

Table 5-1. Front Panel PCB Troubleshooting (cont)

| STEP NO. | ACTION                                                                                                                                                                                                                                                                                          | GO TO STEP FOR CORRECT RESPONSE |    |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----|
|          |                                                                                                                                                                                                                                                                                                 | YES                             | NO |
| 11       | Is Vcc1 present at TP5 ( $\approx 5Vdc$ )?                                                                                                                                                                                                                                                      | 12                              | 15 |
| 12       | Does at least one input data line (D0-D7) toggle?                                                                                                                                                                                                                                               | 13                              | 15 |
| 13       | Do all the outputs of U1 toggle?                                                                                                                                                                                                                                                                | 16                              | 14 |
| 14       | Check U1 and RN1. Repair or replace as required then resume at step 3.                                                                                                                                                                                                                          |                                 |    |
| 15       | Check the connector, cable, and output from the Digital PCB. Repair as required the resume at step 3.                                                                                                                                                                                           |                                 |    |
| 16       | If all the above checks are good, but none of the display segments are illuminated it indicates a massive failure, i.e. two or more components. Check combinations that would effect both the 7-segment and 14-segment displays, e.g. U2 and U3, etc. Repair as required then resume at step 3. |                                 |    |
| 17       | Is the REMOTE indicator illuminated?                                                                                                                                                                                                                                                            | 18                              | 19 |
| 18       | Check for an invalid $\overline{REMOTE}$ input from the Digital PCB. Repair as required then resume at step 17.                                                                                                                                                                                 |                                 |    |
| 19       | Select Math Program #1 (TEST), Test #3 (Key & LED Tests). Push RESET one time to select the first step of the LED test, i.e. all Segments and indicators illuminated.                                                                                                                           |                                 |    |
| 20       | Does the display have the same segment blank in all 7-segment displays?                                                                                                                                                                                                                         | 21                              | 26 |
| 21       | Do all outputs of U9 toggle?                                                                                                                                                                                                                                                                    | 23                              | 22 |
| 22       | Check U9 and its inputs from the digital PCB. Repair as required then resume at step 19.                                                                                                                                                                                                        |                                 |    |
| 23       | Do all inputs to U10/U11 toggle?                                                                                                                                                                                                                                                                | 25                              | 24 |
| 24       | Check U21, CR2 and RN3. Repair as required then resume at step 19.                                                                                                                                                                                                                              |                                 |    |
| 25       | Check for a constant low output from U10/U11. Repair as required then resume at step 19.                                                                                                                                                                                                        |                                 |    |
| 26       | Does the display have the same segment blank in all four sections of the two dual 14-segment displays?                                                                                                                                                                                          | 27                              | 32 |
| 27       | Do all outputs of U12 toggle?                                                                                                                                                                                                                                                                   | 29                              | 28 |
| 28       | Check U12 and its inputs from the digital PCB. Repair as required then resume at step 19.                                                                                                                                                                                                       |                                 |    |
| 29       | Do all inputs to U23/U24 toggle?                                                                                                                                                                                                                                                                | 31                              | 30 |
| 30       | Check U22 and RN6. Repair as required then resume at step 26.                                                                                                                                                                                                                                   |                                 |    |
| 31       | Check for a constant low output from U23/U24. Repair as required then resume at step 19.                                                                                                                                                                                                        |                                 |    |
| 32       | Is one 7-segment display digit and/or one half of a 14-segment display blank?                                                                                                                                                                                                                   | 33                              | 34 |
| 33       | Check that the output from U2/U3 and U1 that drives that segment or segments toggles. Repair as required then resume at step 19.                                                                                                                                                                |                                 |    |
| 34       | Is one segment in one display blank?                                                                                                                                                                                                                                                            | 35                              | 36 |
| 35       | Replace the affected LED. If the problem is not corrected check the land pattern leading to the affected LED. Repair as required then resume at step 19.                                                                                                                                        |                                 |    |
| 36       | Depress RESET one time to advance the display.                                                                                                                                                                                                                                                  |                                 |    |
| 37       | Do any segment(s) still glow, except the decimal point of the first digit?                                                                                                                                                                                                                      | 38                              | 39 |
| 38       | Check U5. Repair as required then resume at step 19.                                                                                                                                                                                                                                            |                                 |    |
| 39       | Depress and release the RESET key switch for each step to sequence through every segment of the 7-segment and 14-segment display.                                                                                                                                                               |                                 |    |
| 40       | Does more than one segment of the display illuminate during any single step of the sequence?                                                                                                                                                                                                    | 41                              | 42 |

Table 5-1. Front Panel PCB Troubleshooting (cont)

| STEP NO. | ACTION                                                                                                                                                                                                        | GO TO STEP FOR CORRECT RESPONSE |    |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----|
|          |                                                                                                                                                                                                               | YES                             | NO |
| 41       | Check the transistor arrays U10, U11, U23, and U24. Repair as required then resume at step 39.                                                                                                                |                                 |    |
| 42       | Depress any Keyswitch except SHIFT to go to the Key portion of Program #1, Test #3.                                                                                                                           |                                 |    |
| 43       | Sequence through the keys checking for the indication shown in Table 5-6.                                                                                                                                     |                                 |    |
| 44       | Are all indications correct?                                                                                                                                                                                  | 50                              | 45 |
| 45       | Does at least one indicator illuminate?                                                                                                                                                                       | 47                              | 46 |
| 46       | Check U6-1/15 for a strobe, check the outputs of U5 for a toggling signal, and check the inputs to U6 with the applicable switch depressed for a pulse. Repair or replace as required then resume at step 42. |                                 |    |
| 47       | Are the indicators correct for the keyswitches that have a display?                                                                                                                                           | 48                              | 49 |
| 48       | Check for a row signal on the switches affected from U5. Repair as required then resume at step 42.                                                                                                           |                                 |    |
| 49       | Check U6 for incorrect test indications. Repair as required then resume at step 42.                                                                                                                           |                                 |    |
| 50       | The Front Panel troubleshooting is complete.                                                                                                                                                                  |                                 |    |

Table 5-2. Digital PCB Troubleshooting

| STEP NO. | ACTION                                                                                                                                                                                                                                                                                                                                                                                          | GO TO STEP FOR CORRECT RESPONSE |    |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----|
|          |                                                                                                                                                                                                                                                                                                                                                                                                 | YES                             | NO |
| 1        | <p>This test of the Digital PCB assumes that the instrument either does not operate correctly, or if the readings are incorrect an attempted Calibration Procedure was unsuccessful.</p> <p style="text-align: center;"><i>NOTE</i></p> <p style="text-align: center;"><i>All measurements made during the procedure are in reference to TP2 (TP10 alternate), unless stated otherwise.</i></p> |                                 |    |
| 2        | Is the Front Panel Display illuminated?                                                                                                                                                                                                                                                                                                                                                         | 21                              | 3  |
| 3        | Is +5V dc present at TP1 (Vcc)?                                                                                                                                                                                                                                                                                                                                                                 | 7                               | 4  |
| 4        | Is Vunreg (approx 8V) present at J12-3,6 (or Front Panel TP7)?                                                                                                                                                                                                                                                                                                                                  | 5                               | 6  |
| 5        | Check U202 and its associated circuitry. Repair as required then resume at step 2.                                                                                                                                                                                                                                                                                                              |                                 |    |
| 6        | Check the rectifier CR1/CR2, the filter on the Transformer PCB A4, and the transformer T201. Repair as required then resume at step 2.                                                                                                                                                                                                                                                          |                                 |    |
| 7        | Is there a high logic level at TP3 ( $\overline{\text{RESET}}$ )?                                                                                                                                                                                                                                                                                                                               | 9                               | 8  |
| 8        | Check the RESET circuit U22, U28, U36, U23, and their associated components. Repair as required then resume at step 2.                                                                                                                                                                                                                                                                          |                                 |    |
| 9        | Is there a 4 MHz clock at TP7?                                                                                                                                                                                                                                                                                                                                                                  | 11                              | 10 |
| 10       | Check Y1 (8 MHz crystal), U19, U20, and their associated components. Repair as required then resume at step 2.                                                                                                                                                                                                                                                                                  |                                 |    |

Table 5-2. Digital PCB Troubleshooting (cont)

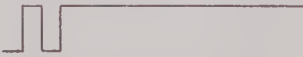
| STEP NO. | ACTION                                                                                                                                                                                                                                                                                                                 | GO TO STEP FOR CORRECT RESPONSE |    |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----|
|          |                                                                                                                                                                                                                                                                                                                        | YES                             | NO |
|          | <p style="text-align: center;"><i>NOTE</i></p> <p><i>An active signal, as used in the remainder of these tests, means a constantly changing logic level, changing levels at a rate that makes it difficult to interpret the data.</i></p>                                                                              |                                 |    |
| 11       | Is there an active signal present at TP6 ( $\overline{\text{INT}}$ )?                                                                                                                                                                                                                                                  | 13                              | 12 |
| 12       | Check U17 and its enabling Interrupt inputs. These include the Phase Lock Loop circuit through U35, DR from the UART through U33-2, and IEEE INTR from the IEEE circuit through U34-12. Repair as required then resume at step 2.                                                                                      |                                 |    |
| 13       | Check the following microprocessor signal points for an active signal:                                                                                                                                                                                                                                                 |                                 |    |
|          | TP5 $\overline{\text{M1}}$ (Output)                                                                                                                                                                                                                                                                                    |                                 |    |
|          | TP8 $\overline{\text{WAIT}}$ (Input)                                                                                                                                                                                                                                                                                   |                                 |    |
|          | U18-20 $\overline{\text{IOREQ}}$ (Output)                                                                                                                                                                                                                                                                              |                                 |    |
|          | U18-19 $\overline{\text{MEMREQ}}$ (Output)                                                                                                                                                                                                                                                                             |                                 |    |
|          | U18-28 $\overline{\text{RFSH}}$ (Output)                                                                                                                                                                                                                                                                               |                                 |    |
|          | U18-21 $\overline{\text{RD}}$ (Output)                                                                                                                                                                                                                                                                                 |                                 |    |
|          | U22 $\overline{\text{WR}}$ (Output)                                                                                                                                                                                                                                                                                    |                                 |    |
| 14       | Are all points active?                                                                                                                                                                                                                                                                                                 | 16                              | 15 |
| 15       | Check for a WAIT input from U33-4 (IEEE WAIT) and U33-5 (U9 circuit with M1 input). If any of the remaining signals are incorrect check the microprocessor U18 (substitution is normally the best method of checking the microprocessor). Repair as required then resume at step 2.                                    |                                 |    |
| 16       | Is there a high logic level at U18-17 ( $\overline{\text{NMI}}$ )?                                                                                                                                                                                                                                                     | 18                              | 17 |
| 17       | Check U1 and its associated components. Repair as required then resume at step 2.                                                                                                                                                                                                                                      |                                 |    |
| 18       | Is U19-8 ( $\overline{\text{DISPLAY BLANK}}$ ) at a high level?                                                                                                                                                                                                                                                        | 20                              | 19 |
| 19       | Check U21, U19, U25, and their controlling inputs. Repair as required then resume at step 2.                                                                                                                                                                                                                           |                                 |    |
| 20       | Refer to the Front Panel Troubleshooting Table. Repair as required then resume at step 2 of this procedure.                                                                                                                                                                                                            |                                 |    |
| 21       | Perform Math Program #1, Test #2.                                                                                                                                                                                                                                                                                      |                                 |    |
| 22       | Does the Front Panel display PASS DGTL only?                                                                                                                                                                                                                                                                           | 33                              | 23 |
| 23       | Is Err 14 ROM displayed during the test?                                                                                                                                                                                                                                                                               | 24                              | 25 |
| 24       | Check the decoder U3. Repeat test #2 while checking the data and address lines of U10, U11, and U12 for an active state. Repair as required then resume at step 21.                                                                                                                                                    |                                 |    |
| 25       | Is Err 15 RAM displayed during the test?                                                                                                                                                                                                                                                                               | 26                              | 27 |
| 26       | Check the decoder U2. Repeat test #2 while checking the data and address lines of U4 through U7 for an active state. Repair as required then resume at step 21.                                                                                                                                                        |                                 |    |
| 27       | Is Err 17 HDWR displayed during the test?                                                                                                                                                                                                                                                                              | 28                              | 21 |
| 28       | Perform Math Program #1, Test #4.                                                                                                                                                                                                                                                                                      |                                 |    |
|          | <p style="text-align: center;"><i>NOTE</i></p> <p><i>This test program constantly sends a hex 40 (0100 0000) across the guard crossing from the digital microprocessor to the analog microprocessor, and back to the digital microprocessor. This is in addition to the sequential signal sent to the display.</i></p> |                                 |    |
| 29       | Is the waveform reproduced below present at U26-20 (UART SI)?                                                                                                                                                                                                                                                          | 31                              | 30 |
|          |                                                                                                                                                                                                                                     |                                 |    |

Table 5-2. Digital PCB Troubleshooting (cont)

| STEP NO.  | ACTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | GO TO STEP FOR CORRECT RESPONSE |        |       |       |       |        |       |       |        |        |       |        |  |  |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|--------|-------|-------|-------|--------|-------|-------|--------|--------|-------|--------|--|--|
|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | YES                             | NO     |       |       |       |        |       |       |        |        |       |        |  |  |
| 30        | Is the waveform above present at U26-25 (UART SO)?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 31                              | 32     |       |       |       |        |       |       |        |        |       |        |  |  |
| 31        | Check the UART U26, the address and data lines, and the microprocessor U18. Repair as required then resume at step 21.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                 |        |       |       |       |        |       |       |        |        |       |        |  |  |
| 32        | Proceed through the guard crossing circuit checking the waveform at each component. The waveform should be similar to the one shown below, i.e. the data level a burst of ac; however, the base line level will vary between components due to inverting gates or circuits. Check the signal at U30-4, U37-5, and U38-14 on the digital PCB; U627-3, U602-20, U602-25, U614-12, U610-3, and U627-9 on the Analog PCB; and U38-6 and U36-4 on the digital PCB. If the signal goes into the analog UART but does not come out refer to the Analog PCB troubleshooting table. Repair as required then resume at step 21.<br> |                                 |        |       |       |       |        |       |       |        |        |       |        |  |  |
| 33        | Does an attempted measurement reading result in an Err 3(X) UART or Err A(X) GARD display?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 34                              | 37     |       |       |       |        |       |       |        |        |       |        |  |  |
| 34        | Check the phase lock loop for the proper signals for the actual input line voltages.<br><table><tr><td>Line Freq</td><td>U29-14</td><td>U29-4</td></tr><tr><td>50 Hz</td><td>50 Hz</td><td>400 Hz</td></tr><tr><td>60 Hz</td><td>60 Hz</td><td>480 Hz</td></tr><tr><td>400 Hz</td><td>57 Hz</td><td>457 Hz</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                               | Line Freq                       | U29-14 | U29-4 | 50 Hz | 50 Hz | 400 Hz | 60 Hz | 60 Hz | 480 Hz | 400 Hz | 57 Hz | 457 Hz |  |  |
| Line Freq | U29-14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | U29-4                           |        |       |       |       |        |       |       |        |        |       |        |  |  |
| 50 Hz     | 50 Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 400 Hz                          |        |       |       |       |        |       |       |        |        |       |        |  |  |
| 60 Hz     | 60 Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 480 Hz                          |        |       |       |       |        |       |       |        |        |       |        |  |  |
| 400 Hz    | 57 Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 457 Hz                          |        |       |       |       |        |       |       |        |        |       |        |  |  |
| 35        | Are the signals correct for the input line voltage?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 37                              | 36     |       |       |       |        |       |       |        |        |       |        |  |  |
| 36        | Check U29, U28, U32, U23, and their associated components. If the problem is not in the Phase Lock Loop check the UART circuit beginning at step 28. Repair as required then resume at step 33.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                 |        |       |       |       |        |       |       |        |        |       |        |  |  |
| 37        | Is the instrument used in an IEEE system?<br><p style="text-align: center;"><i>NOTE</i></p> <p><i>The assumption is made at this time that the instrument can be controlled, and responds correctly, to local commands from the Front Panel. Accuracy of the instrument has not, as yet, been verified.</i></p>                                                                                                                                                                                                                                                                                                                                                                                            | 38                              | 46     |       |       |       |        |       |       |        |        |       |        |  |  |
| 38        | Connect the instrument to an IEEE Bus and address it from the Bus Controller.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                 |        |       |       |       |        |       |       |        |        |       |        |  |  |
| 39        | Does the front panel REMOTE indicator illuminate?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 41                              | 40     |       |       |       |        |       |       |        |        |       |        |  |  |
| 40        | Verify the LED and R1 are good, and that voltage is present on the front panel, then check U8. Repair as required then resume at step 38.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                 |        |       |       |       |        |       |       |        |        |       |        |  |  |
| 41        | Does the instrument correctly respond to IEEE commands?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 46                              | 42     |       |       |       |        |       |       |        |        |       |        |  |  |
| 42        | Depress the Front Panel RESET switch twice in rapid succession to reset the instrument and observe the Front Panel Display for the correct IEEE address as set on the IEEE Address switches.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                 |        |       |       |       |        |       |       |        |        |       |        |  |  |
| 43        | Is the correct address displayed?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 45                              | 44     |       |       |       |        |       |       |        |        |       |        |  |  |
| 44        | Check for the following signals: ASE to pulse with the reset, the Data Bus lines, the 1 MHz clock, M1, WR, IOREQ, IEEE WAIT, and IEEE ADDR are active. Check U102, S103, and RN101 for address errors or incorrect data lines. Check U103 through U106 and their associated components for problems in the other lines. If the above signals are correct check U101. Repair as required then resume at step 38.                                                                                                                                                                                                                                                                                            |                                 |        |       |       |       |        |       |       |        |        |       |        |  |  |

**Table 5-2. Digital PCB Troubleshooting (cont)**

| STEP NO. | ACTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | GO TO STEP FOR CORRECT RESPONSE |    |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----|
|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | YES                             | NO |
| 45       | Give a command from the system controller while checking gates U107 through U110 for the same response, observing the correct signal flow direction (U108 through U110 are bi-directional). If the signals respond correctly check U101. These components can be checked by substitution or with a static bus controller (e.g. the Ziatech ZT-488). Techniques for troubleshooting using static bus controllers are explained in Fluke TB-13. Repair as required then resume at step 38. |                                 |    |
| 46       | Test of the Digital PCB is complete. If readings are incorrect check the Analog PCB using the Analog Troubleshooting Table.                                                                                                                                                                                                                                                                                                                                                              |                                 |    |

**Table 5-3. Analog PCB Troubleshooting**

| STEP NO. | ACTION                                                                                                                                                                                                                                                                                                                                                                                             | GO TO STEP FOR CORRECT RESPONSE |    |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----|
|          |                                                                                                                                                                                                                                                                                                                                                                                                    | YES                             | NO |
|          | <p style="text-align: center;"><i>NOTE</i></p> <p><i>The test in this table assumes that the instrument responds to front panel commands and the fault is one of incorrect readings rather than a massive failure. A calibration adjustment procedure should be attempted prior to troubleshooting.</i></p>                                                                                        |                                 |    |
| 1        | Remove any leads connected to the instrument input terminals.                                                                                                                                                                                                                                                                                                                                      |                                 |    |
| 2        | Select Math Program #1 (TEST), Test #1 (Analog).                                                                                                                                                                                                                                                                                                                                                   |                                 |    |
| 3        | Step completely through the test, recording the number of any sub-tests that fail.                                                                                                                                                                                                                                                                                                                 |                                 |    |
| 4        | Did any sub-test fail?                                                                                                                                                                                                                                                                                                                                                                             | 5                               | 14 |
| 5        | Did only one sub-test fail?                                                                                                                                                                                                                                                                                                                                                                        | 9                               | 6  |
| 6        | Compare the numbers of the failed sub-tests against the examples given in Table 5-7, comparing for a duplicate failure pattern.                                                                                                                                                                                                                                                                    |                                 |    |
| 7        | Does the failure pattern match one of those in the table?                                                                                                                                                                                                                                                                                                                                          | 8                               | 9  |
| 8        | Check the component indicated and its associated circuitry. Repair or replace as required then resume at step 2.                                                                                                                                                                                                                                                                                   |                                 |    |
| 9        | Check the Analog Controller Output latches for the test(s) that failed using the applicable line(s) of Table 5-8.                                                                                                                                                                                                                                                                                  |                                 |    |
| 10       | Are the latches in the states listed for that sub-test in the table?                                                                                                                                                                                                                                                                                                                               | 13                              | 11 |
| 11       | Perform the analog controller latch test described in the Troubleshooting Paragraph.                                                                                                                                                                                                                                                                                                               |                                 |    |
| 12       | Do all the latches perform as required?                                                                                                                                                                                                                                                                                                                                                            | 13                              | 8  |
| 13       | Trace the analog signal for the failed subtest through the applicable circuit(s) using the simplified schematics in Figures 5-1 through 5-7, and the typical test point voltages and Waveforms in Table 5-5. If the trouble is isolated to the Analog Controller or A/D Converter refer to the tests in the text portion of the troubleshooting section. Repair as required then resume at step 2. |                                 |    |
| 14       | Is the trouble in low ohms (<20 Kohms)?                                                                                                                                                                                                                                                                                                                                                            | 15                              | 18 |

**Table 5-3. Analog PCB Troubleshooting (cont)**

| STEP NO. | ACTION                                                                                                                                                             | GO TO STEP FOR CORRECT RESPONSE |    |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----|
|          |                                                                                                                                                                    | YES                             | NO |
| 15       | Check the low ohms circuit using Table 5-9.                                                                                                                        |                                 |    |
| 16       | Are all circuit indications as shown in the Table?                                                                                                                 | 18                              | 17 |
| 17       | Trace the signal path for the failed low ohms test through the circuit using Table 5-5, typical Voltages and Waveforms. Repair as required then resume at step 15. |                                 |    |
| 18       | Perform the Calibration Adjustment procedure given in Section 6 of the 8520A Calibration Manual.                                                                   |                                 |    |
| 19       | Can the Calibration Adjustment procedure be successfully completed?                                                                                                | 21                              | 20 |
| 20       | Trace the defective adjustment circuit using the typical voltage and waveform in Table 5-5 and the schematics. Repair as required then resume at step 18.          |                                 |    |
| 21       | Troubleshooting the analog circuits is complete.                                                                                                                   |                                 |    |

**Table 5-4. Error Codes**

| ERROR | DISPLAY             | EXPLANATION                                                                                            |
|-------|---------------------|--------------------------------------------------------------------------------------------------------|
| 00    | Blank               | No Errors                                                                                              |
| 01    | Err01 HV            | High Voltage present with ohms function selected                                                       |
| 02    | None                | Syntax error during remote operation                                                                   |
| 03    | Err03 NOVR          | Numeric or register overflow                                                                           |
| 03    | Err03 RTD           | Failure of RTC algorithm to coverage                                                                   |
| 04    | Err04 KEY           | Invalid use of a control                                                                               |
| 05    | Err05 FLTR          | Cannot increase filter in ASYNC reading rate                                                           |
| 06    | Err06 ZERO          | ZERO (Math Program #2) cannot be selected with the VAC or VA+D function                                |
| 07    | Err07 IEEE          | IEEE-488 input buffer overflow                                                                         |
| 08    | or VXRF             | External Reference input $\geq \pm 16.5V$ dc with Math Program #3 selected                             |
| 09    | ur VXRF             | $\pm 0.5V$ dc difference between EXTERNAL REFERENCE HI and LO terminals with Math Program #3 selected. |
| 10    | HHHHH<br>(function) | Normal input overrange                                                                                 |
| 11    | Err11 HDWR          | Improper echo from A/D Microprocessor                                                                  |
| 12    | rrtoo FAST          | Reading rate too fast for selected filter and/or Math Program                                          |
| 14    | Err14 ROM           | ROM checksum error                                                                                     |
| 15    | Err15 RAM           | RAM does not check out                                                                                 |
| 16    | Err16 LINE          | Cannot determine line frequency at POWER ON                                                            |
| 17    | Err17 HDWR          | Sync failure between the microprocessor and the A/D Converter                                          |
| 18    | OPen INPUT          | V/ $\Omega$ INPUT terminals not open during Analog Test (Math Program #1)                              |
| 22    | Err22 HDWR          | Error while measuring volts for ohms change                                                            |
| 23    | Err23 HDWR          | Time error, incorrect response from A/D Converter                                                      |
| 24    | Err24 HDWR          | Resync error: instrument controller to A/D Converter                                                   |
| 25    | Err25 HDWR          | Ohms Reference Error                                                                                   |
| 30    | Err30 UART          | No A/D response to microprocessor within time limits                                                   |
| 31    | Err31 UART          | Microprocessor detects parity error                                                                    |
| 32    | Err32 UART          | Microprocessor detects overrun error                                                                   |
| 33    | Err33 UART          | Parity and overrun errors (Error Codes 31 & 32)                                                        |

Table 5-4. Error Codes (cont)

| ERROR | DISPLAY    | EXPLANATION                                                    |
|-------|------------|----------------------------------------------------------------|
| 34    | Err34 UART | Microprocessor detects framing error                           |
| 35    | Err35 UART | Parity and framing error (Error Codes 31 & 34)                 |
| 36    | Err36 UART | Overrun and framing errors (Error Codes 32 & 34)               |
| 37    | Err37 UART | Parity, overrun, and framing errors (Error Codes 31, 32, & 34) |
| A1    | ErrA1 GARD | Undefined interrupt at A/D                                     |
| A3    | ErrA3 GARD | Analog interrupt activated                                     |
| A5    | ErrA5 GARD | Parity, overrun, or framing error at A/D                       |
| A7    | ErrA7 GARD | Illegal command at A/D                                         |

Table 5-5. Typical Voltages and Waveforms

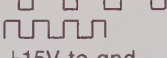
| HI TP  | LO TP | HI MNEMONIC               | TYPICAL READING/WAVEFORM W/INPUT                                                    |                                                                                     |                                                                                     | REMARKS                                                      |
|--------|-------|---------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------|
|        |       |                           | 10V dc                                                                              | 10V ac @ 400 Hz                                                                     | 1K $\Omega$                                                                         |                                                              |
|        |       | <b>Analog</b>             |                                                                                     |                                                                                     |                                                                                     |                                                              |
| 102    | 103   | DC INPUT                  | +10V dc                                                                             | N/A                                                                                 | -1V dc                                                                              |                                                              |
| 104    | 103   | MUX OUT                   | +10V dc                                                                             | +10V dc                                                                             | -1V dc                                                                              |                                                              |
| 202    | 207   | BUF INP                   | +10V dc                                                                             | +10V dc                                                                             | -1V dc                                                                              |                                                              |
| 204    | 207   | MEAS                      |    |    |    | Peak $\approx$ 2V + input V<br>Base $\approx$ -.5V + input V |
| 205    | 207   | ZERO                      |    |    |    |                                                              |
| 206    | 207   | BUF OUT                   | +10V dc                                                                             | 10V dc                                                                              | +8V dc                                                                              |                                                              |
| Q227-5 | 207   |                           | +12 $\pm$ 2V dc                                                                     | +12 $\pm$ 2V dc                                                                     | +10 $\pm$ 2V dc                                                                     |                                                              |
| Q234-5 | 207   |                           | +12 $\pm$ 2V dc                                                                     | +12 $\pm$ 2V dc                                                                     | +10 $\pm$ 2V dc                                                                     |                                                              |
| 304    | 302   | 20V                       | N/A                                                                                 | N/A                                                                                 | 20V dc                                                                              |                                                              |
| 305    | 302   | 0V                        | N/A                                                                                 | N/A                                                                                 | 0V dc                                                                               |                                                              |
| 306    | 302   | SRLO                      | N/A                                                                                 | N/A                                                                                 | -1.3V dc                                                                            |                                                              |
| U403-7 | 402   | +8V                       | N/A                                                                                 | +8.0V dc                                                                            | N/A                                                                                 |                                                              |
| U403-4 | 402   | -8V                       | N/A                                                                                 | -8.0V dc                                                                            | N/A                                                                                 |                                                              |
| 401    | 402   | AC INP                    | N/A                                                                                 | 10V dc                                                                              | N/A                                                                                 |                                                              |
| 403    | 402   | BAL OUT                   | N/A                                                                                 |  | N/A                                                                                 | Peak $\approx$ 0.9V above baseline                           |
| 404    | 402   | SQ RT                     | N/A                                                                                 | -0.57V dc                                                                           | N/A                                                                                 |                                                              |
| 405    | 402   |                           | N/A                                                                                 |  | N/A                                                                                 | Peak $\approx$ 0.9V below baseline                           |
| 502    | 501   | +V <sub>REF</sub>         | +6.5V dc                                                                            | +6.5V dc                                                                            | +6.5V dc                                                                            |                                                              |
| 503    | 501   | -V <sub>REF</sub>         | -6.5V dc                                                                            | -6.5V dc                                                                            | -6.5V dc                                                                            |                                                              |
| 505    | 501   | A/D INPUT                 | +10V dc                                                                             | +10V dc                                                                             | +8V dc                                                                              |                                                              |
| 508    | 501   | INT OUT                   |  |  |  | Dependent upon A/D Input<br>Synced to TP 509                 |
| 603    | 604   |                           | +5V Logic High                                                                      |                                                                                     |                                                                                     | -15V to gnd                                                  |
| 602    | 604   | $\overline{\text{ALE}}$   |  |  |  | PERIOD = 2.5 $\mu$ S                                         |
| 605    | 604   | 2 MHz                     |  |  |  | 2 MHz Clock                                                  |
| 606    | 604   | $\overline{\text{INT}}$   | +5V Logic High                                                                      | +5V Logic High                                                                      | +15V to gnd                                                                         | -15V to gnd                                                  |
| 601    | 604   | $\overline{\text{RESET}}$ | +5V Logic High                                                                      | +5V Logic High                                                                      | +5V Logic High                                                                      | -15V to gnd                                                  |
| 703    | 705   | +27V                      | +27.6 $\pm$ 1.1V dc                                                                 | +27.6 $\pm$ 1.1V dc                                                                 | +27.6 $\pm$ 1.1V dc                                                                 |                                                              |
| 704    | 705   | +15V                      | +15 $\pm$ 0.6V dc                                                                   | +15 $\pm$ 0.6V dc                                                                   | +15 $\pm$ 0.6V dc                                                                   |                                                              |
| 706    | 705   | -15V                      | -15 $\pm$ 0.6V dc                                                                   | -15 $\pm$ 0.6V dc                                                                   | -15 $\pm$ 0.6V dc                                                                   |                                                              |
| 707    | 705   | -27V                      | -27.6 $\pm$ 1.1V dc                                                                 | -27.6 $\pm$ 1.1V dc                                                                 | -27 $\pm$ 1.1V dc                                                                   |                                                              |
| 701    | 702   | -15 LH                    | +5 +0.2/-0.1V dc                                                                    | +5 +0.2/-0.1V dc                                                                    | +5 +0.2/-0.1V dc                                                                    | -15V High -20V Low                                           |

Table 5-5. Typical Voltages and Waveforms (cont)

| HI<br>TP | LO<br>TP | HI<br>MNEMONIC | TYPICAL READING/WAVEFORM W/INPUT                                                  |                 |             | REMARKS             |
|----------|----------|----------------|-----------------------------------------------------------------------------------|-----------------|-------------|---------------------|
|          |          |                | 10V dc                                                                            | 10V ac @ 400 Hz | 1K $\Omega$ |                     |
|          |          | <b>Digital</b> |                                                                                   |                 |             |                     |
| 1        | 2        | Vcc            | +5+0.2/-0.1V dc                                                                   |                 |             |                     |
| 3        | 2        | RESET          | +5V Logic High                                                                    |                 |             |                     |
| 4        | 2        |                | +5V Logic High                                                                    |                 |             |                     |
| 5        | 2        | M $\bar{I}$    |  |                 |             |                     |
| 6        | 2        | INT            |  |                 |             |                     |
| 7        | 2        | $\phi$         |  |                 |             |                     |
| 8        | 2        | WAIT           |  |                 |             |                     |
| 101      | 013      | IEEE ENABLE    |  |                 |             |                     |
| 102      | 103      | IEEE TRIGGER   | Logic Low                                                                         |                 |             |                     |
| 201      | 202      | Vcc            | +5 +0.2/-0.1V dc                                                                  |                 |             | 1 ms<br>-.1 $\mu$ s |

Table 5-6. Keyswitch Test

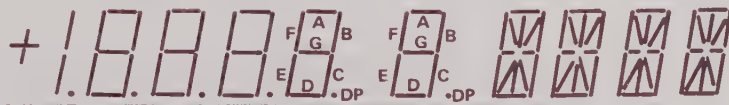
| KEYSWITCH                   |  |    |
|-----------------------------|------------------------------------------------------------------------------------|----|
| VDC (+/-)                   | D                                                                                  | DP |
| VAC (7)                     | C                                                                                  | DP |
| $\Omega$ 2 WIRE (8)         | DP                                                                                 | E  |
| $\Omega$ 4 WIRE (8)         | G                                                                                  | E  |
| nS (CE)                     | F                                                                                  | E  |
| PROGRAMS IN USE/OFF         | E                                                                                  | E  |
| STATUS (MENU)               | G                                                                                  | G  |
| BURST SIZE                  | F                                                                                  | G  |
| BURST LOCATION              | E                                                                                  | G  |
| AUTO RANGE (.)              | D                                                                                  | G  |
| ▲RANGE (4)                  | C                                                                                  | G  |
| ▼RANGE (5)                  | DP                                                                                 | D  |
| EXT/AUTP TRIGGER (6)        | G                                                                                  | D  |
| ARM BNC TRIGGER (EXP)       | F                                                                                  | D  |
| MANUAL TRIGGER              | E                                                                                  | D  |
| PROGRAM SELECTION           | F                                                                                  | F  |
| PROGRAM DATA                | E                                                                                  | F  |
| READING RATE ▲(0)           | D                                                                                  | F  |
| READING RATE ▼(1)           | C                                                                                  | F  |
| FILTER ▼(2)                 | DP                                                                                 | C  |
| FILTER ▲(3)                 | G                                                                                  | C  |
| LOCAL(/)                    | F                                                                                  | C  |
| AT the Same Time:           |                                                                                    |    |
| SHIFT and PROGRAM SELECTION | G and F                                                                            | F  |
| At the Same Time:           |                                                                                    |    |
| RESET and nS (CE)           | D and F                                                                            | E  |

Table 5-7. Analog Test Failure Patterns

| FAILED TEST |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
|-------------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|
| 1           | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| X           | X | X |   | X | X | X | X | X | X  | X  | X  | X  | X  | X  | X  |
|             |   |   | X |   |   |   |   |   |    |    |    |    |    |    |    |
| X           |   |   | X | X |   |   |   |   |    |    |    |    |    |    |    |
|             | X |   |   |   | X |   |   |   |    |    |    |    |    |    |    |
|             |   | X |   |   |   | X | X |   |    |    |    |    |    |    |    |
|             |   |   | X | X | X | X | X |   |    |    |    | X  | X  | X  | X  |
|             |   |   |   | X | X | X | X |   |    |    |    |    | X  | X  | X  |
|             |   |   |   |   |   |   | X |   |    |    | X  |    |    |    |    |
|             |   |   |   |   |   |   |   | X | X  | X  | X  | X  | X  | X  | X  |
|             |   |   |   |   |   |   | X |   |    |    | X  |    |    |    |    |
|             |   |   |   |   |   |   |   | X |    |    |    | X  |    |    |    |
|             |   |   |   |   |   |   |   |   | X  |    |    |    | X  |    |    |
|             |   |   |   |   |   |   |   |   |    | X  |    |    |    | X  |    |

K102 remains energized  
 K102 does not energize  
 DC Buffer X1 amplifier  
 DC Buffer X8 amplifier  
 DC Buffer X64 amplifier  
 Reference Voltage, R321, K103 remains energized, K101 does not energize  
 K303 does not energize  
 K303 remains energized  
 K104 does not energize, K401 does not energize  
 AC Converter Range 1V (Q401, 408, 409, 421 on)  
 AC Converter Range 10V (Q401, 402, 408, 409 on)  
 AC Converter Range 100V (Q403, 404, 421 on)  
 AC Converter Range 650V (Q405, 406, 407, 421 on)

Table 5-8. Analog Controller Latch Outputs

| IC#  | PIN# | MNEMONIC      | ACTIVE STATE | ANALOG TEST NO. |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |   |   |  |   |
|------|------|---------------|--------------|-----------------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|---|---|--|---|
|      |      |               |              | 1               | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |   |   |  |   |
| U618 | 2    | X REF LO      | L            | H               |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | H |   |  |   |
|      | 5    | X REF HI      | L            | H               |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | H |   |  |   |
|      | 6    | DC X 1        | L            | L               | H | H | L | L | H | H | H | L | L  | L  | L  | L  | L  | L  |    |   |   |  |   |
|      | 9    | DC X 8        | L            | H               | L | H | H | H | L | H |   |   |    |    |    |    |    |    |    |   | H |  |   |
|      | 12   | DC X 64       | L            | H               | H | L | H | H | H | L | L | H |    |    |    |    |    |    |    |   |   |  | H |
|      | 15   | FAST DC       | L            | H               |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | H |   |  |   |
|      | 16   | SLOW DC       | L            | L               |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | L |   |  |   |
|      | 19   | No Connection | X            | L               |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | L |   |  |   |
| U619 | 2    | LOW DC        | H            | L               | L | L | H | L |   |   |   |   |    |    |    |    |    |    | L  |   |   |  |   |
|      | 5    | LOW OHMS      | H            | L               |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | L |   |  |   |
|      | 6    | 2T/4T SEL     | H            | L               | L | L | H | H | H | H | H | L | L  | L  | L  | H  | H  | H  | H  |   |   |  |   |
|      | 9    | No Connection | X            | H               |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | H |   |  |   |
|      | 12   | REF           | L            | H               |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | H |   |  |   |
|      | 15   | DC +          | L            | L               |   |   |   |   |   | L | H |   |    |    |    |    | H  |    |    |   |   |  |   |
|      | 16   | AC V          | L            | H               |   |   |   |   |   | H | L |   |    |    |    |    | L  |    |    |   |   |  |   |
|      | 19   | AC V          | H            | L               |   |   |   |   |   | L | H |   |    |    |    |    | H  |    |    |   |   |  |   |
| U620 | 2    | SAC           | L            | L               |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | L |   |  |   |
|      | 5    | FAC           | L            | H               |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | H |   |  |   |
|      | 6    | 10V AC        | H            | L               |   |   |   |   |   | L | H | L | L  | L  | H  | L  | L  |    |    |   |   |  |   |
|      | 9    | 100V AC       | L            | H               |   |   |   |   |   | H | L | H | H  | H  | L  | H  |    |    |    |   |   |  |   |
|      | 12   | 10V AC        | L            | H               |   |   |   |   |   | H | L | H | H  | H  | L  | H  | H  |    |    |   |   |  |   |
|      | 15   | 1V AC         | L            | H               |   |   |   |   |   | H | L | L | H  | H  | L  | H  | H  |    |    |   |   |  |   |
|      | 16   | 1 KV AC       | L            | L               |   |   |   |   |   | L | H | H | H  | L  | H  | H  | L  |    |    |   |   |  |   |
|      | 19   | K401          | H            | H               |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | H |   |  |   |
| U621 | 2    | No Connection | X            | L               |   |   |   |   |   | L | H | L |    |    |    |    |    | L  |    |   |   |  |   |
|      | 5    | No Connection | X            | L               |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | L |   |  |   |
|      | 6    | No Connection | X            | L               |   |   |   |   |   | L | H | L |    |    |    |    |    | L  |    |   |   |  |   |
|      | 9    | HIGH OHMS     | L            | H               | H | H | L | L | L | L | L | H | H  | H  | H  | L  | L  | L  |    |   |   |  |   |
|      | 12   | 200 K         | L            | H               | H | H | L | L | L | L | H | H | H  | H  | H  | L  | L  | L  |    |   |   |  |   |
|      | 15   | 20 +200       | L            | H               |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | H |   |  |   |
|      | 16   | 2 K           | L            | H               |   |   |   |   |   | H | L | H |    |    |    |    |    | H  |    |   |   |  |   |
|      | 19   | OHMS CLAMP    | L            | L               |   |   |   |   |   | L | H | L |    |    |    |    |    | L  |    |   |   |  |   |

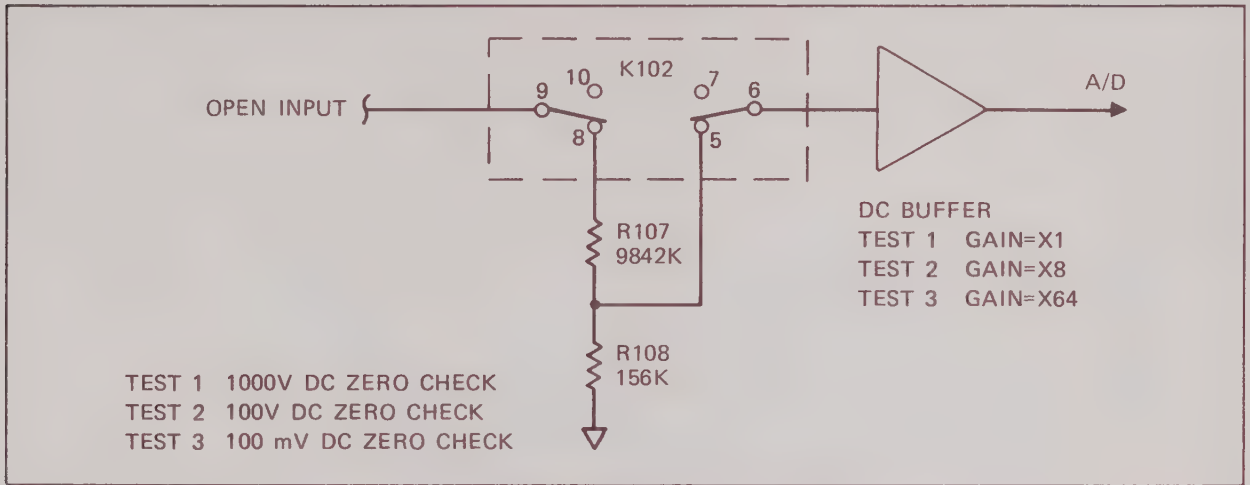


Figure 5-1. Analog Self Tests #1, 2, 3 Simplified Schematic

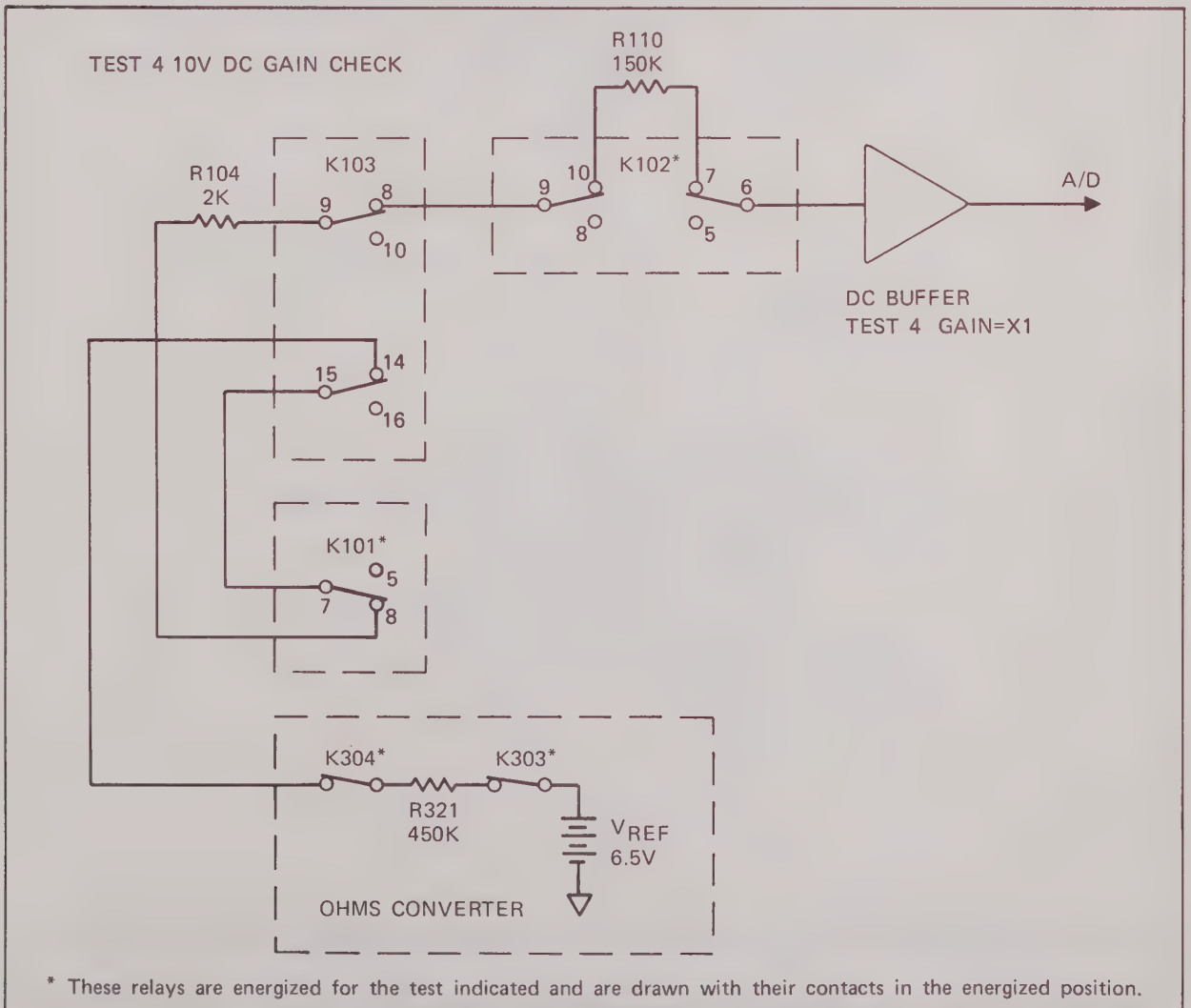
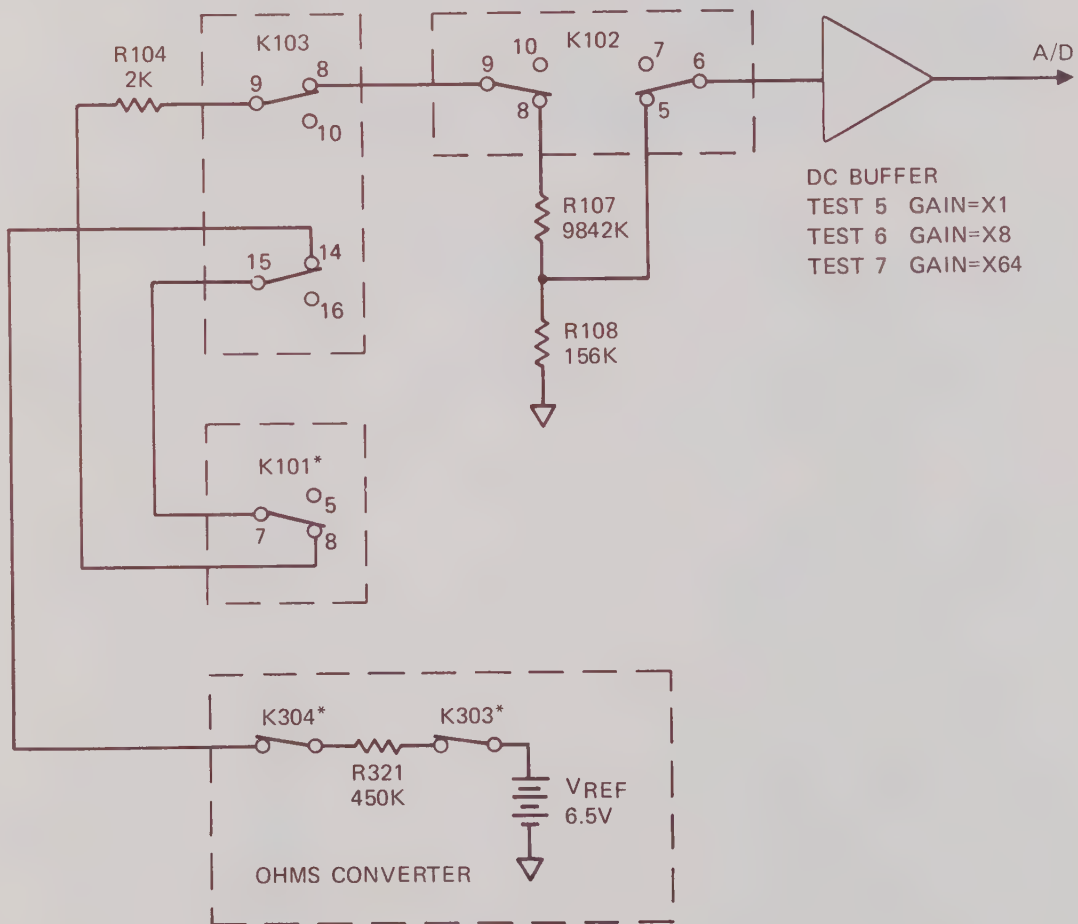


Figure 5-2. Analog Self Test #4 Simplified Schematic

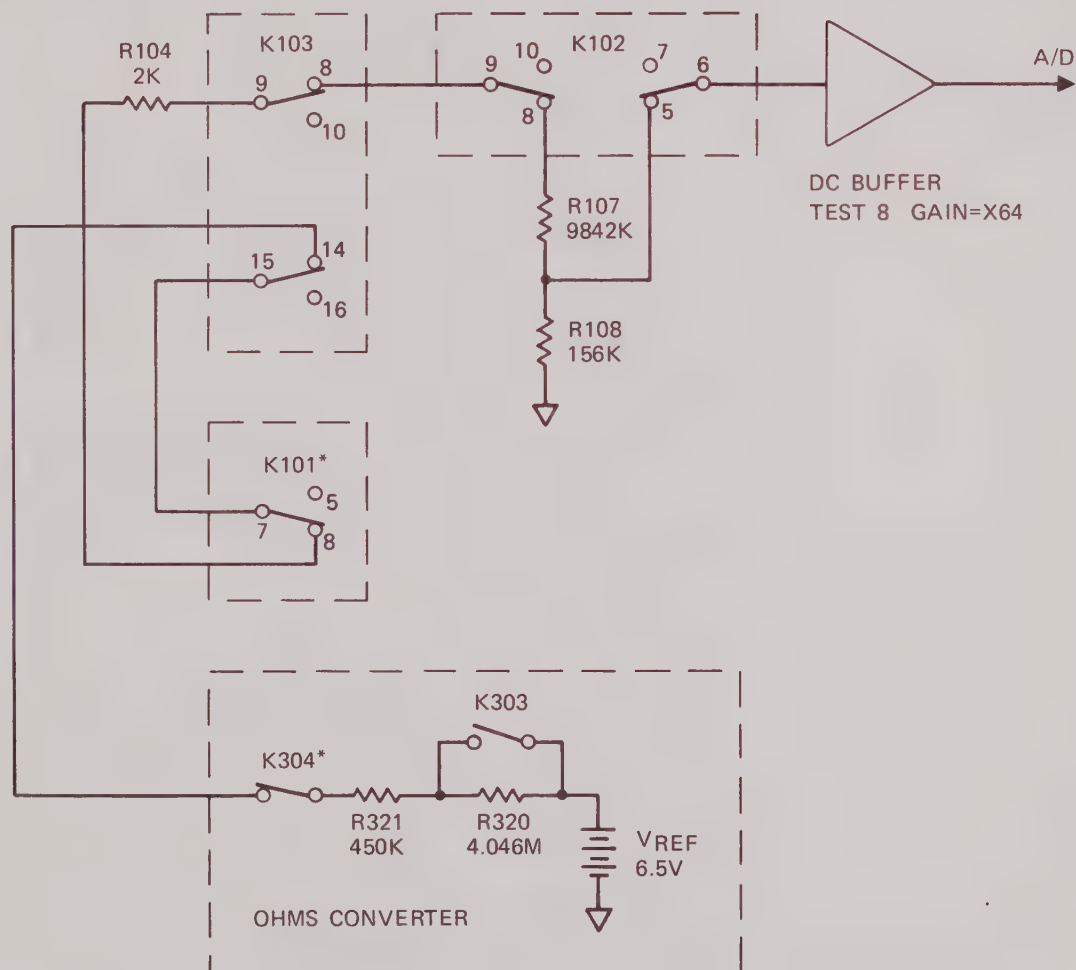
TEST 5 1000V DC GAIN CHECK  
 TEST 6 100V DC GAIN CHECK  
 TEST 7 100 mV DC GAIN CHECK



\* These relays are energized for the tests indicated and are drawn with their contacts in the energized position.

Figure 5-3. Analog Self Tests #5, 6, 7 Simplified Schematic

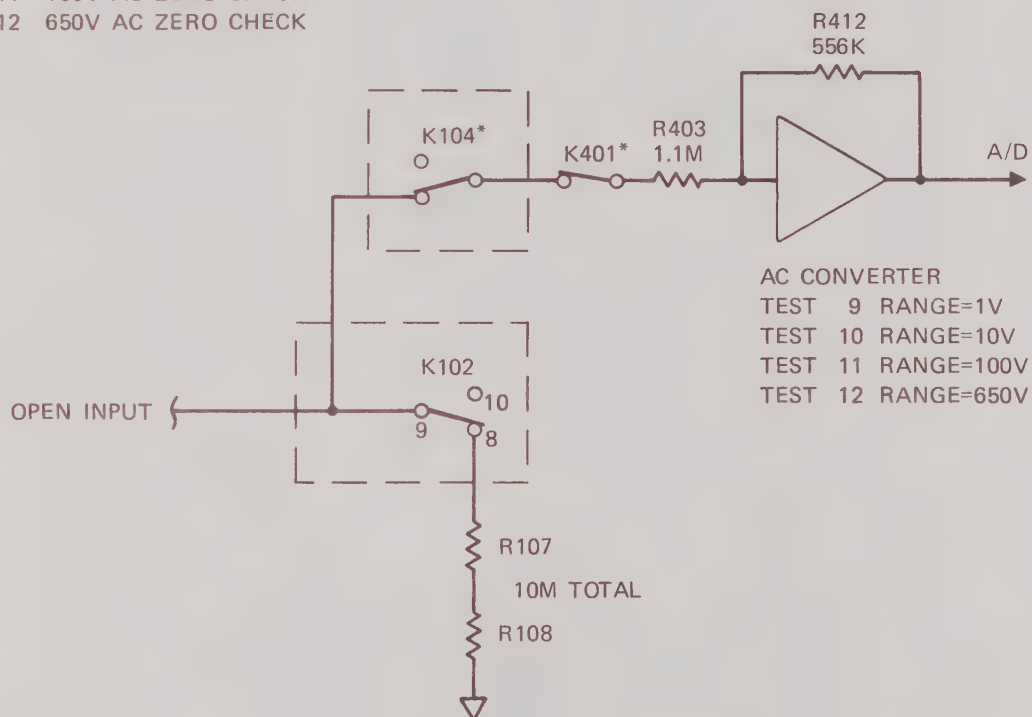
## TEST 8 10M OHM RANGE CHECK



\* These relays are energized for the test indicated and are drawn with their contacts in the energized position.

Figure 5-4. Analog Self Test #8 Simplified Schematic

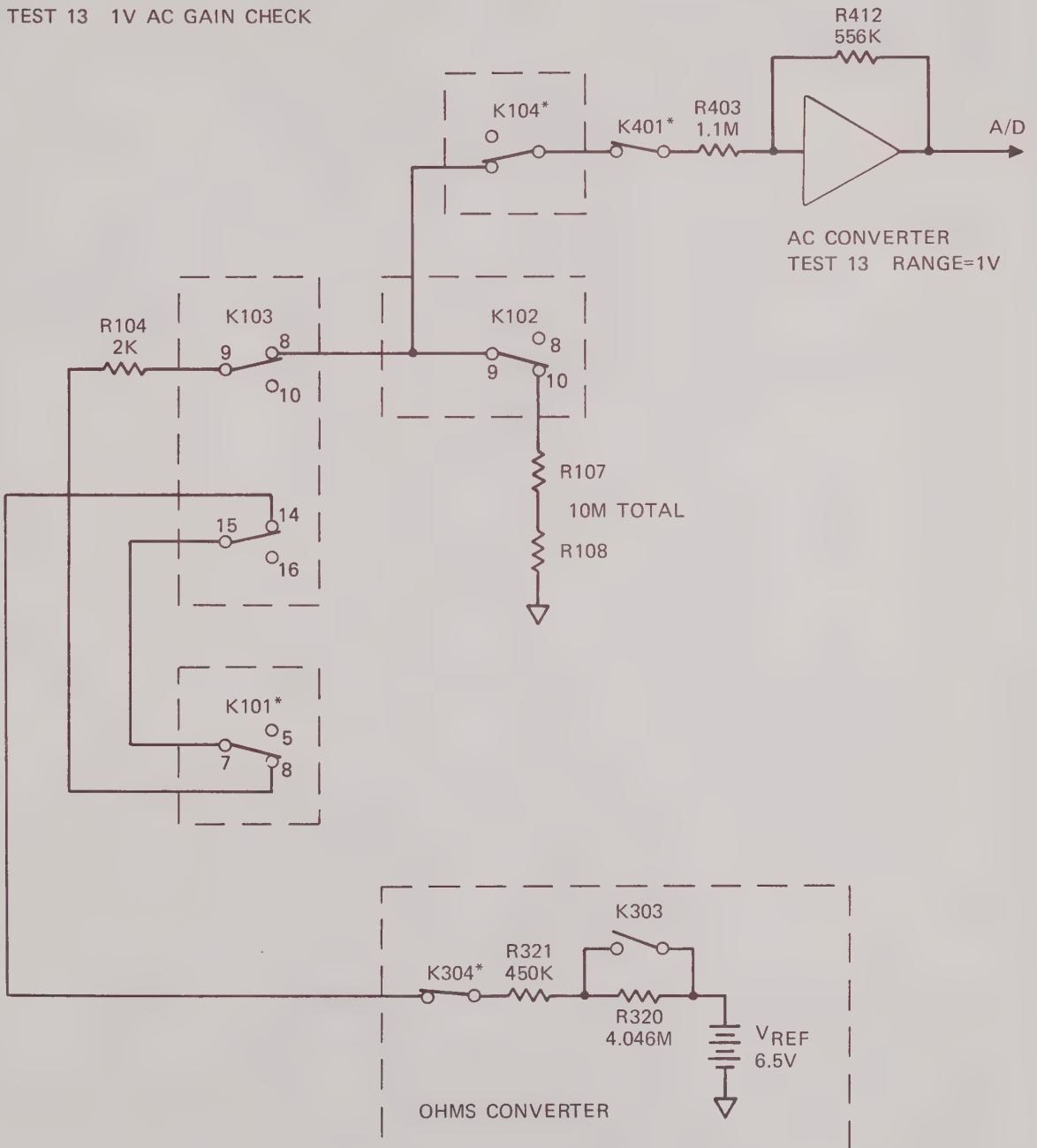
TEST 9 1V AC ZERO CHECK  
 TEST 10 10V AC ZERO CHECK  
 TEST 11 100V AC ZERO CHECK  
 TEST 12 650V AC ZERO CHECK



\* These relays are energized for the tests indicated and are drawn with their contacts in the energized position.

Figure 5-5. Analog Self Tests #9, 10, 11, 12 Simplified Schematic

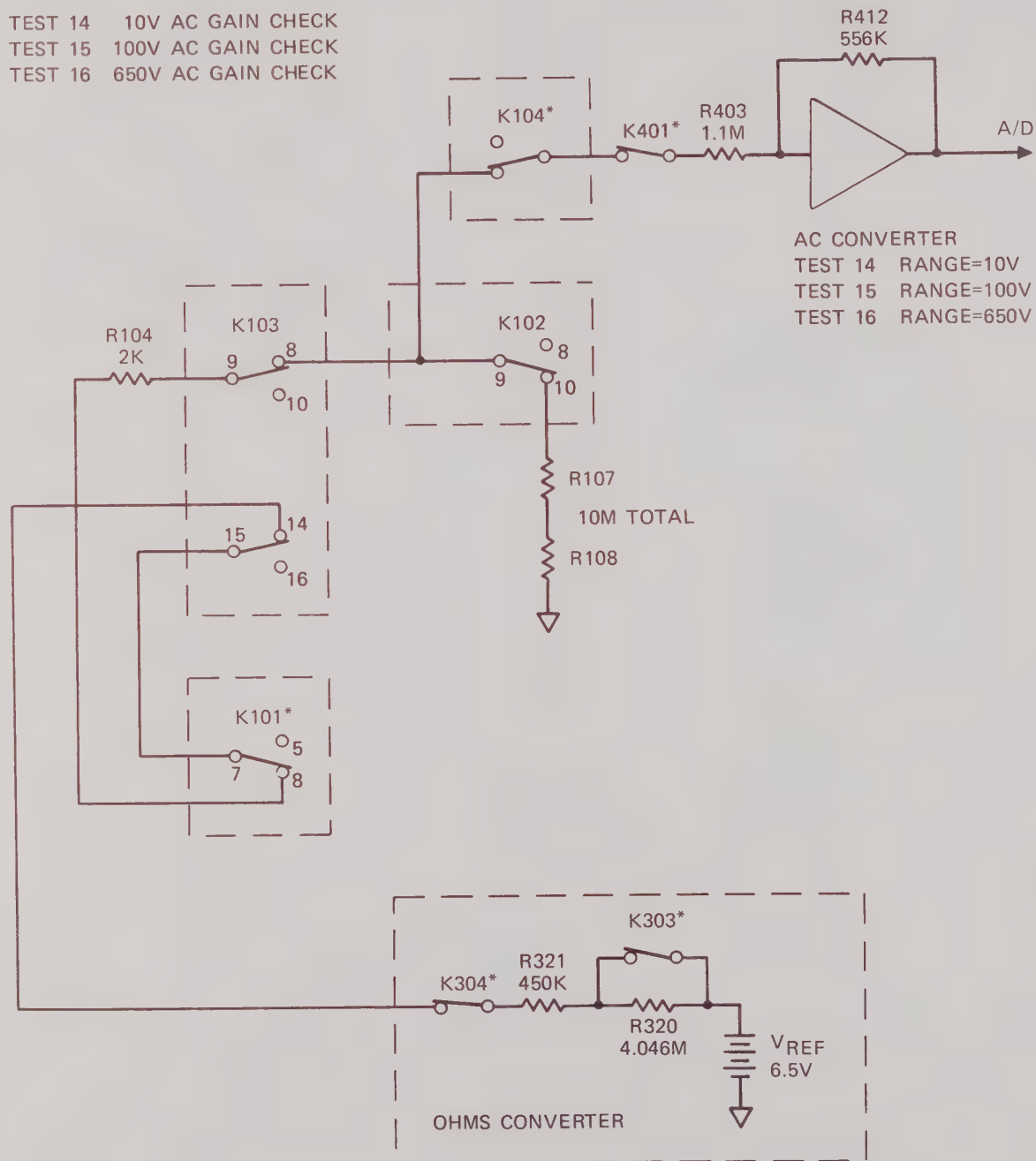
## TEST 13 1V AC GAIN CHECK



\* These relays are energized for the test indicated and are drawn with their contacts in the energized position.

Figure 5-6. Analog Self Test #13 Simplified Schematic

TEST 14 10V AC GAIN CHECK  
 TEST 15 100V AC GAIN CHECK  
 TEST 16 650V AC GAIN CHECK



\* These relays are energized for the tests indicated and are drawn with their contacts in the energized position.

Figure 5-7. Analog Self Tests #14, 15, 16 Simplified Schematic

Table 5-9. Low Ohms Tests

|                | 4 TERMINAL<br>10 $\Omega$ | 4 TERMINAL<br>100 $\Omega$ | 4 TERMINAL<br>1000 $\Omega$ | 4 TERMINAL<br>10 K $\Omega$ |
|----------------|---------------------------|----------------------------|-----------------------------|-----------------------------|
| K101           | OFF                       | OFF                        | OFF                         | OFF                         |
| K102           | ON                        | ON                         | ON                          | ON                          |
| K103           | ON                        | ON                         | ON                          | ON                          |
| K104           | OFF                       | OFF                        | OFF                         | OFF                         |
| Q103           | OFF                       | OFF                        | OFF                         | OFF                         |
| Q104           | ON                        | ON                         | ON                          | ON                          |
| Q106           | OFF                       | OFF                        | OFF                         | OFF                         |
| Q107           | OFF                       | OFF                        | OFF                         | OFF                         |
| Q108           | OFF                       | OFF                        | OFF                         | OFF                         |
| GAIN DC BUFFER | 64                        | 8                          | 8                           | 8                           |
| Q236           | OFF                       | OFF                        | OFF                         | OFF                         |
| Q237           | OFF                       | ON                         | ON                          | ON                          |
| Q238           | ON                        | OFF                        | OFF                         | OFF                         |
| Q308           | OFF                       | OFF                        | OFF                         | OFF                         |
| Q305           | ON                        | ON                         | OFF                         | OFF                         |
| Q306           | OFF                       | OFF                        | ON                          | OFF                         |
| K301           | OFF                       | OFF                        | ON                          | OFF                         |
| K302           | ON                        | ON                         | OFF                         | OFF                         |
| K304           | OFF                       | OFF                        | OFF                         | OFF                         |

Table 5-10. Analog Controller Latch Tests

| TESTS  | S601 Switch Number |     |     |     | LOCATION                        |
|--------|--------------------|-----|-----|-----|---------------------------------|
|        | 1                  | 2   | 3   | 4   |                                 |
| Port 2 | OFF                | OFF | OFF | OFF | U601-21-24, 35-38               |
| Port 1 | OFF                | OFF | OFF | ON  | U601-27-34                      |
| U617   | OFF                | OFF | ON  | OFF | U617-2, 5, 7, 10, 12            |
| U621   | OFF                | OFF | ON  | ON  | U621-2, 5, 6, 9, 12, 15, 16, 19 |
| U620   | OFF                | ON  | OFF | OFF | U620-2, 5, 6, 9, 12, 15, 16, 19 |
| U619   | OFF                | ON  | OFF | ON  | U619-2, 5, 6, 9, 12, 15, 16, 19 |
| U618   | OFF                | ON  | ON  | OFF | U618-2, 5, 6, 9, 12, 15, 16, 19 |
| U604   | OFF                | ON  | ON  | ON  | U604-1-11, 13                   |

Table 5-11. Analog Controller UART Test

| PORT 1<br>BYTE | U601 (PORT 1) |           |           | RESPONSE                                                                                                                                                                                                                                                                                                                           |
|----------------|---------------|-----------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | 29<br>(2)     | 28<br>(1) | 27<br>(0) |                                                                                                                                                                                                                                                                                                                                    |
| 0000 0001      | L             | L         | H         | The interrupt mask has been set for local echo and even parity (data 10 Hex) and a data byte (A9 Hex) written into the UART. The software has written 01 Hex into Port 1 and is waiting for the TBE bit (U602-22) to be set true.                                                                                                  |
| 0000 0010      | L             | H         | L         | After receipt of TBE the software writes a 02 Hex in Port 1 and waits for DAV (U602-19) to be set true.                                                                                                                                                                                                                            |
| 0000 0011      | L             | H         | H         | After receipt of DAV the software writes 03 Hex in Port 1 and compares E3 Hex with the UART status, i.e. U602 pins 24 (EOC), 22 (TBE), and 19 (DAV) high, pins 13 (PE), 14 (FE), and 15 (OR) low, and U601 pins 18 (D6) and 19 (D7) are high. If they are the same the test continues, otherwise it stops with 03 Hex in the Port. |
| 0000 0100      | H             | L         | L         | If the status byte matches, the software writes 04 Hex into Port 1 and compares the UART data to A9 Hex. If they are the same the test continues, otherwise it stops with 04 Hex in the Port.                                                                                                                                      |

Table 5-12. Analog Controller Interrupt Test

| PORT 1<br>BYTE | U601 (PORT 1) |           |           |           | RESPONSE                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|---------------|-----------|-----------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | 30<br>(3)     | 29<br>(2) | 28<br>(1) | 27<br>(0) |                                                                                                                                                                                                                                                                                                                                                                                                     |
| 0000 0100      | L             | H         | L         | L         | The software writes 04 Hex in Port 1 and 11 Hex on the data lines for the interrupt mask register (U607) for local echo, even parity, and DAV interrupt enable. Local echo strobes the UART write line (U602-23) and a data byte is transferred out on U602-25 to the digital circuitry and then back on U602-20. The software then waits for U601-6 (INT) to go low before going to the next step. |
| 0000 0101      | L             | H         | L         | H         | When INT goes low the software writes 05 Hex in Port 1 and compares the interrupt vector with F1 Hex to insure that U601 pins 16, 17, 18, and 19 are high during the interrupt vector strobe (U604-7) and that only the DAV interrupt is active. If they compare the test continues, otherwise it stops with 05 Hex in the port.                                                                    |
| 0000 0110      | L             | H         | H         | L         | If there is a match the software writes 06 Hex in port 1 and 10 Hex on the data lines to disable the interrupt. It then verifies that INT on U601-6 goes high.                                                                                                                                                                                                                                      |
| 0000 0111      | L             | H         | H         | H         | When INT goes high the software writes 07 Hex in Port 1 and F4 Hex in the interrupt mask register (U607). It then strobes the UART write line (U602-23) then clocks U608-9 high through U614-12 and U610-3. When INT (U601-6) goes low it continues with the test, otherwise it stops with 07 Hex in the Port.                                                                                      |
| 0000 1000      | H             | L         | L         | L         | When INT goes low the software writes 08 Hex in Port 1 and compares the interrupt vector with F4 Hex to verify that U601 pins 16, 17, 18, and 19 are high during the interrupt vector strobe (U604-7) and that only the TRIGGER interrupt (U608-9) is active. If they compare the test repeats itself, otherwise it stops with 08 Hex in the Port.                                                  |

Table 5-13. UART and Interrupt Troubleshooting Procedures

| STEP NO. | ACTION                                                                                                                                                                                                                                                   | GO TO STEP FOR CORRECT RESPONSE |    |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----|
|          |                                                                                                                                                                                                                                                          | YES                             | NO |
|          | <i>NOTE</i><br><i>The first 9 steps are the same regardless of the test that failed.</i>                                                                                                                                                                 |                                 |    |
| 1        | Check the CPU (U601) for defective pins on the ports or outputs. Repeat the failed test.                                                                                                                                                                 |                                 |    |
| 2        | Does the test operate satisfactorily?                                                                                                                                                                                                                    | 21                              | 3  |
| 3        | Check the IC's Connected to the data bus for shorted or defective pins. They are U603, U607, U611, U612, U617, U618, U619, U620, and U621. Repeat the failed test.                                                                                       |                                 |    |
| 4        | Does the test operate satisfactorily?                                                                                                                                                                                                                    | 21                              | 5  |
| 5        | Check the reset circuitry (U605, U609, and U614), that initiates the test by forcing a reading of the program. Repeat the failed test.                                                                                                                   |                                 |    |
| 6        | Does the test operate satisfactorily?                                                                                                                                                                                                                    | 21                              | 7  |
| 7        | Check the address decoding circuitry (U603, U604, U613, and U614). Repeat the failed test.                                                                                                                                                               |                                 |    |
| 8        | Does the test operate satisfactorily?                                                                                                                                                                                                                    | 21                              | 9  |
| 9        | Check the UART (U602).                                                                                                                                                                                                                                   |                                 |    |
| 10       | Does the test operate satisfactorily?                                                                                                                                                                                                                    | 21                              | 11 |
| 11       | Is the port locked in 02 Hex during the UART Test?                                                                                                                                                                                                       | 12                              | 14 |
| 12       | Check U607, U610, and U615. Repeat the failed test.                                                                                                                                                                                                      |                                 |    |
| 13       | Does the test operate satisfactorily?                                                                                                                                                                                                                    | 21                              | 20 |
| 14       | Is the port locked in either 03 Hex or 04 Hex during the UART Test or in one of the Interrupt tests?                                                                                                                                                     | 15                              | 16 |
| 15       | Check the UART Transmit/Receive circuitry (U609, U610, U612, and U615). Repeat the failed test.                                                                                                                                                          |                                 |    |
| 16       | Does the test operate satisfactorily?                                                                                                                                                                                                                    | 21                              | 20 |
| 17       | Is the port locked in any of the Interrupt Tests?                                                                                                                                                                                                        | 18                              | 20 |
| 18       | Check the Interrupt circuitry (U607, U608, U612, and U613). Repeat the failed test.                                                                                                                                                                      |                                 |    |
| 19       | Does the test operate satisfactorily?                                                                                                                                                                                                                    | 21                              | 20 |
| 20       | All checks have been completed; however, the instrument still does not perform the test satisfactorily. Repeat all checks looking for a failure that took place during the checks. Check for open or shorted land patterns and other tests of this type. |                                 |    |
| 21       | Troubleshooting of the UART and Interrupt circuits is complete.                                                                                                                                                                                          |                                 |    |

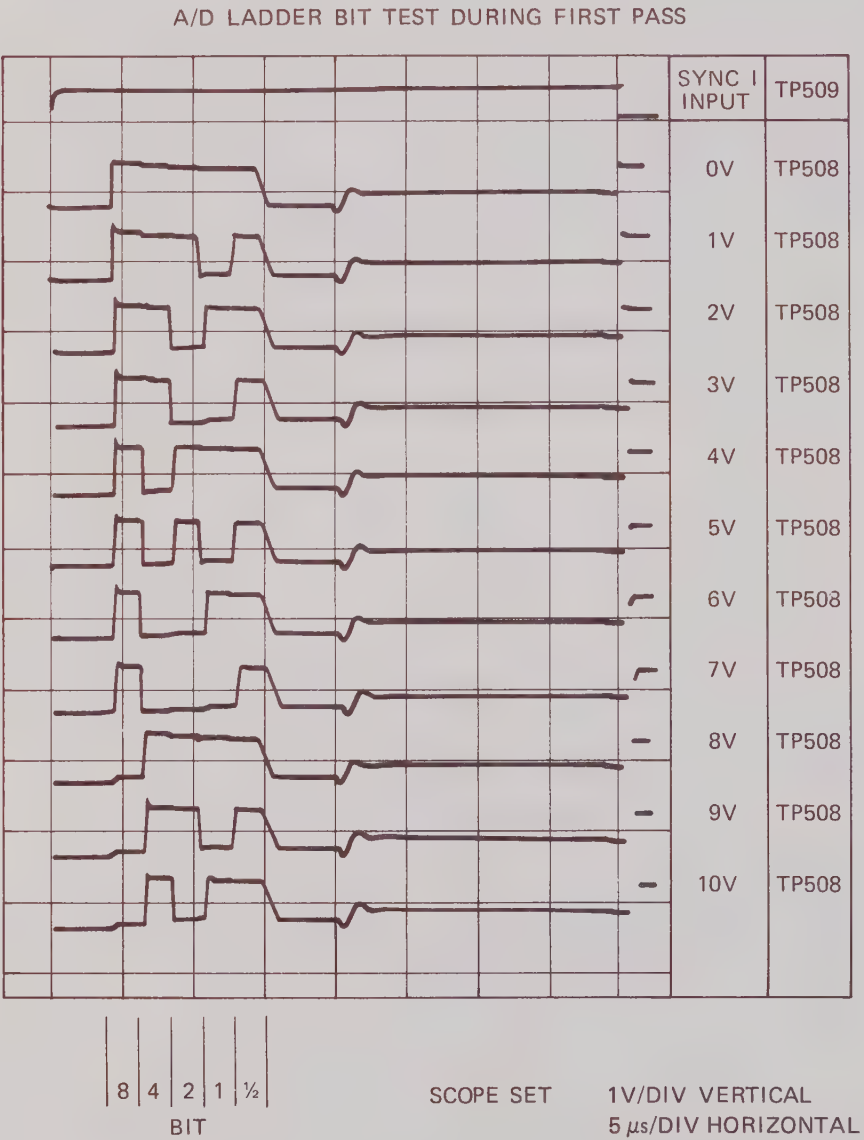


Figure 5-8. A/D Converter Test

# Section 6

## List of Replaceable Parts

### TABLE OF CONTENTS

| ASSEMBLY NAME                              | DRAWING<br>NO.  | TABLE |      | FIGURE |      |
|--------------------------------------------|-----------------|-------|------|--------|------|
|                                            |                 | NO.   | PAGE | NO.    | PAGE |
| Final Assembly .....                       | 8520A T & B, FA | 6-1   | 6-3  | 6-1    | 6-5  |
| A1 Display PCB Assembly .....              | 8520A-4011      | 6-2   | 6-10 | 6-2    | 6-12 |
| A2 Digital (Controller) PCB Assembly ..... | 8520A-4020      | 6-3   | 6-13 | 6-3    | 6-18 |
| A3 Analog PCB Assembly .....               | 8520A-4030      | 6-4   | 6-20 | 6-4    | 6-32 |
| A4 Transformer Assembly .....              | 8520A-4202      | 6-6   | 6-36 | 6-6    | 6-37 |
|                                            | 8520A-4040      |       |      |        |      |

## 6-1. INTRODUCTION

6-2. This section contains an illustrated parts breakdown of the instrument. A similar parts listing for each of the Options will be found in Section 6. Components are listed alphanumerically by assembly. Both electrical and mechanical components are listed by reference designation. Each listed part is shown in an accompanying illustration.

6-3. Parts lists include the following information:

1. Reference Designation.
2. Description of each part.
3. FLUKE Stock Number.
4. Federal Supply Code for Manufactures. (See Section 7 for Code-to-Name list.)
5. Manufacture's Part Number.
6. Total Quantity of components per assembly.
7. Recommended Quantity: This entry indicates the recommended number of spare parts necessary to support one to five instruments for a period of 2 years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for 1 year or more at an isolated site, it is recommended that at least one of each assembly in the instrument be stocked (see paragraph 5-7). In the case of optional subassemblies, plug-ins, etc., that are not always part of the instrument, or are deviations from the basic instrument model, the REC QTY column lists the recommended spares quantity for the items in that particular assembly.

## 6-4. HOW TO OBTAIN PARTS

6-5. Components may be ordered directly from the manufacturer by using the manufacturer's part number, or from the John Fluke Mfg. Co., Inc. or its authorized representatives by using the FLUKE STOCK NUMBER. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

6-6. To ensure prompt and efficient handling of your order, include the following information.

1. Quantity.
2. FLUKE Stock Number.
3. Description.
4. Reference Designation.
5. Printed Circuit Board Part Number and Revision Letter.
6. Instrument Model and Serial Number.

6-7. A Recommended Spare Parts Kit for your basic instrument is available from the factory. This kit contains those items listed in the REC QTY column of the parts list in the quantities recommended.

6-8. Parts price information is available from the John Fluke Mfg. Co., Inc. or its representatives. Prices are also available in a Fluke Replacement Parts Catalog, which is available on request.

### CAUTION

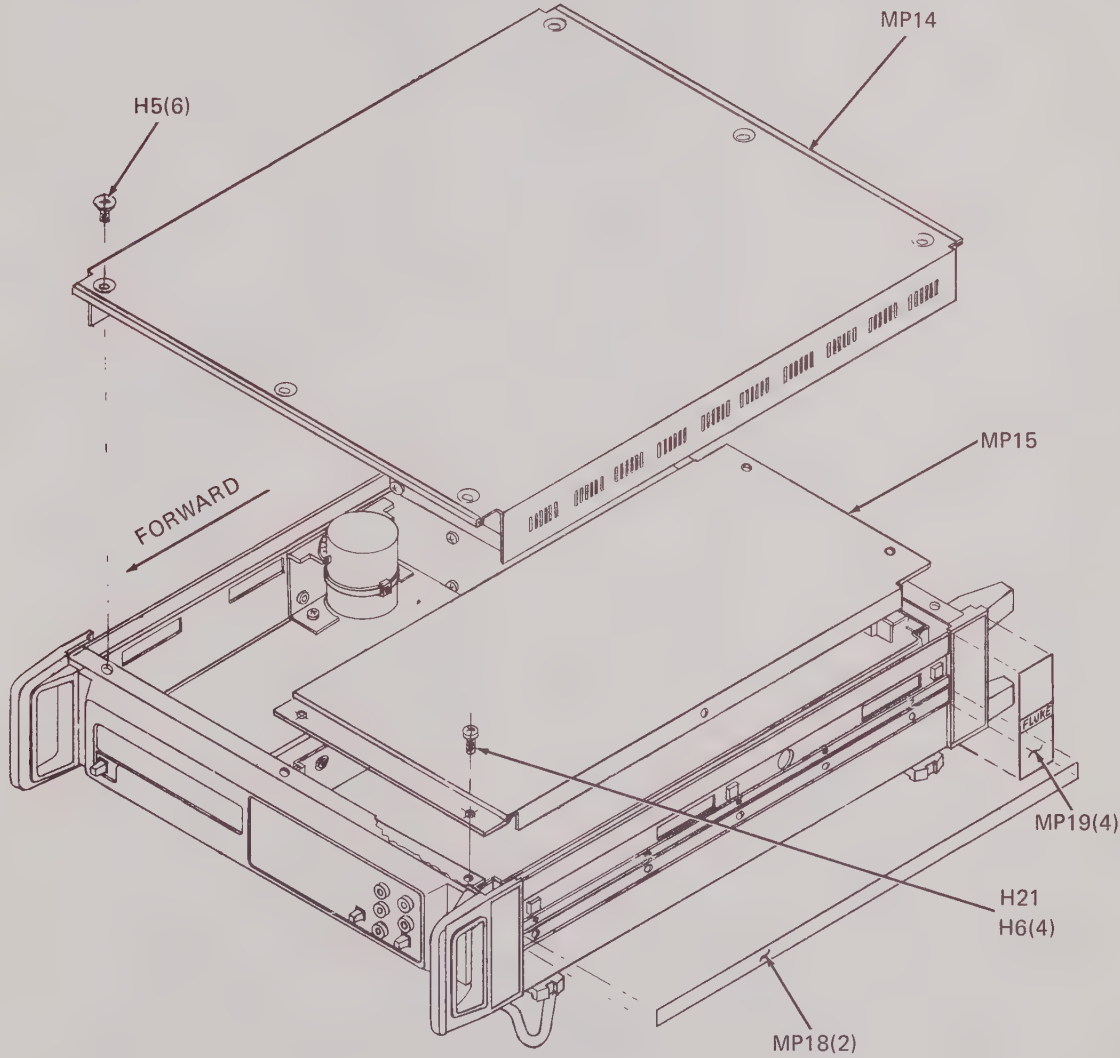
**Indicated devices are subject to damage by static discharge.**

Table 6-1. 8520A Final Assembly

| REF<br>DES                                          | DESCRIPTION                       | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|-----------------------------------------------------|-----------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| 8520A FINAL ASSEMBLY<br>FIGURE 6-1 (8520A-T&B/5001) |                                   |                       |                     |                         |            |            |                  |
| A1                                                  | ② DISPLAY PCB ASSEMBLY            | 516625                | 89536               | 516625                  | 1          |            |                  |
| A2                                                  | DIGITAL CONTROLLER PCB ASSEMBLY   | 496828                | 89536               | 496828                  | 1          |            |                  |
| A3                                                  | ANALOG PCB ASSEMBLY               | 496836                | 89536               | 496836                  | 1          |            |                  |
| A4                                                  | TRANSFORMER ASSEMBLY              | 496869                | 89536               | 496869                  | 1          |            |                  |
| F201                                                | FUSE, SLOW BLOW, .5 AMP           | 109322                | 71400               | MDL1-2                  | 1          |            | 5                |
| H1                                                  | NUT, 1/4 X 28 (TO J9)             | 110619                | 89536               | 110619                  | 2          |            |                  |
| H2                                                  | NUT, #4-40                        | 147611                | 89536               | 147611                  | 2          |            |                  |
| H3                                                  | SCREW, PHP, 4-40 X 1/4            | 256156                | 89536               | 256156                  | 6          |            |                  |
| H4                                                  | SCREW, PHP, 6-32 X 5/16           | 424713                | 73734               | 19043                   | 9          |            |                  |
| H5                                                  | SCREW, FHP, 6-32 X 1/4, U/CUT     | 320093                | 89536               | 320093                  | 12         |            |                  |
| H6                                                  | SCREW, PNP, 6-32 X 1/4            | 385401                | 89536               | 385401                  | 4          |            |                  |
| H7                                                  | SCREW, PHP, 6-32 X 1/4            | 385401                | 89536               | 385401                  | 36         |            |                  |
| H9                                                  | SCREW, PHP, 6-32 X 3/8            | 334458                | 89536               | 334458                  | 4          |            |                  |
| H10                                                 | SCREW, PHP, W/LKWSHR, 6-32 X 1/2  | 177030                | 89536               | 177030                  | 4          |            |                  |
| H11                                                 | SCREW, SOCKET, #8-32              | 295105                | 89536               | 295105                  | 4          |            |                  |
| H12                                                 | SCREW, FHP, #8-32 X 3/8           | 114116                | 89536               | 114116                  | 8          |            |                  |
| H13                                                 | SCREW, FHP, #8-32 X 1/2           | 256206                | 89536               | 256206                  | 8          |            |                  |
| H14                                                 | SCREW, PHP, #8-32 X 5/8           | 293324                | 89536               | 293324                  | 4          |            |                  |
| H15                                                 | WASHER, FLAT, #6                  | 110270                | 89536               | 110270                  | 1          |            |                  |
| H16                                                 | WASHER, LOCK (TO J9)              | 110817                | 89536               | 110817                  | 2          |            |                  |
| H18                                                 | WASHER, LOCK, #8                  | 110320                | 89536               | 110320                  | 4          |            |                  |
| H20                                                 | WASHER, #4                        | 147603                | 89536               | 147603                  | 4          |            |                  |
| H21                                                 | WASHER, #6                        | 403923                | 89536               | 403923                  | 42         |            |                  |
| H22                                                 | SCREW, PHP, 4-40 X 3/16           | 129882                | 89536               | 129882                  | 2          |            |                  |
| H23                                                 | WASHER, MYLAR                     | 240820                | 89536               | 240820                  | 2          |            |                  |
| J6                                                  | CABLE, REAR INPUT                 | 496885                | 89536               | 496885                  | 1          |            |                  |
| J7                                                  | BNC CABLE ASSY                    | 515668                | 89536               | 515668                  | 1          |            |                  |
| J9                                                  | POST, BINDING, GROUND (W/MP2)     | 225623                | 20584               | 3576                    | 1          |            |                  |
| J10                                                 | FILTER, LINE RECEPTACLE           | 321273                | 05245               | 3EF2                    | 1          |            |                  |
| MP1                                                 | BAIL, FULL WIDTH                  | 231407                | 89536               | 231407                  | 1          |            |                  |
| MP2                                                 | BINDING HEAD, GROUND (PART OF J9) | 225615                | 20584               | 3575                    | 1          |            |                  |
| MP3                                                 | BULKHEAD, CENTER                  | 491100                | 89536               | 491100                  | 1          |            |                  |
| MP4                                                 | BUTTON (TO S101, S102)            | 472316                | 89536               | 472316                  | 2          |            |                  |
| MP5                                                 | CHASSIS, ANALOG ASSY              | 496802                | 89536               | 496802                  | 1          |            |                  |
| MP6                                                 | CHASSIS SIDE, LEFT                | 491084                | 89536               | 491084                  | 1          |            |                  |
| MP7                                                 | CHASSIS SIDE, RIGHT               | 491092                | 89536               | 491092                  | 1          |            |                  |
| MP10                                                | CONNECTOR KIT                     | 494773                | 00779               | 552633-4                | 1          |            |                  |
| MP11                                                | COVER, BOTTOM, 18" PACKAGE        | 491191                | 89536               | 491191                  | 1          |            |                  |
| MP12                                                | COVER, BOTTOM GUARD               | 490979                | 89536               | 490979                  | 1          |            |                  |
| MP13                                                | CORNER, PLASTIC                   | 394338                | 89536               | 394338                  | 2          |            |                  |
| MP14                                                | COVER, TOP (18")                  | 491183                | 89536               | 491183                  | 1          |            |                  |
| MP15                                                | COVER, TOP-GUARD                  | 490987                | 89536               | 490987                  | 1          |            |                  |
| MP16                                                | DECAL, MOLDED FRONT PANEL         | 523712                | 89536               | 523712                  | 1          |            |                  |
| MP18                                                | DECAL, SIDE TRIM                  | 525998                | 89536               | 525998                  | 2          |            |                  |
| MP19                                                | DECAL, SIDE                       | 394379                | 89536               | 394379                  | 4          |            |                  |
| MP20                                                | FOOT, BAIL STAND                  | 292870                | 89536               | 292870                  | 4          |            |                  |
| MP21                                                | FOOT, REAR PANEL                  | 307363                | 89536               | 307363                  | 4          |            |                  |

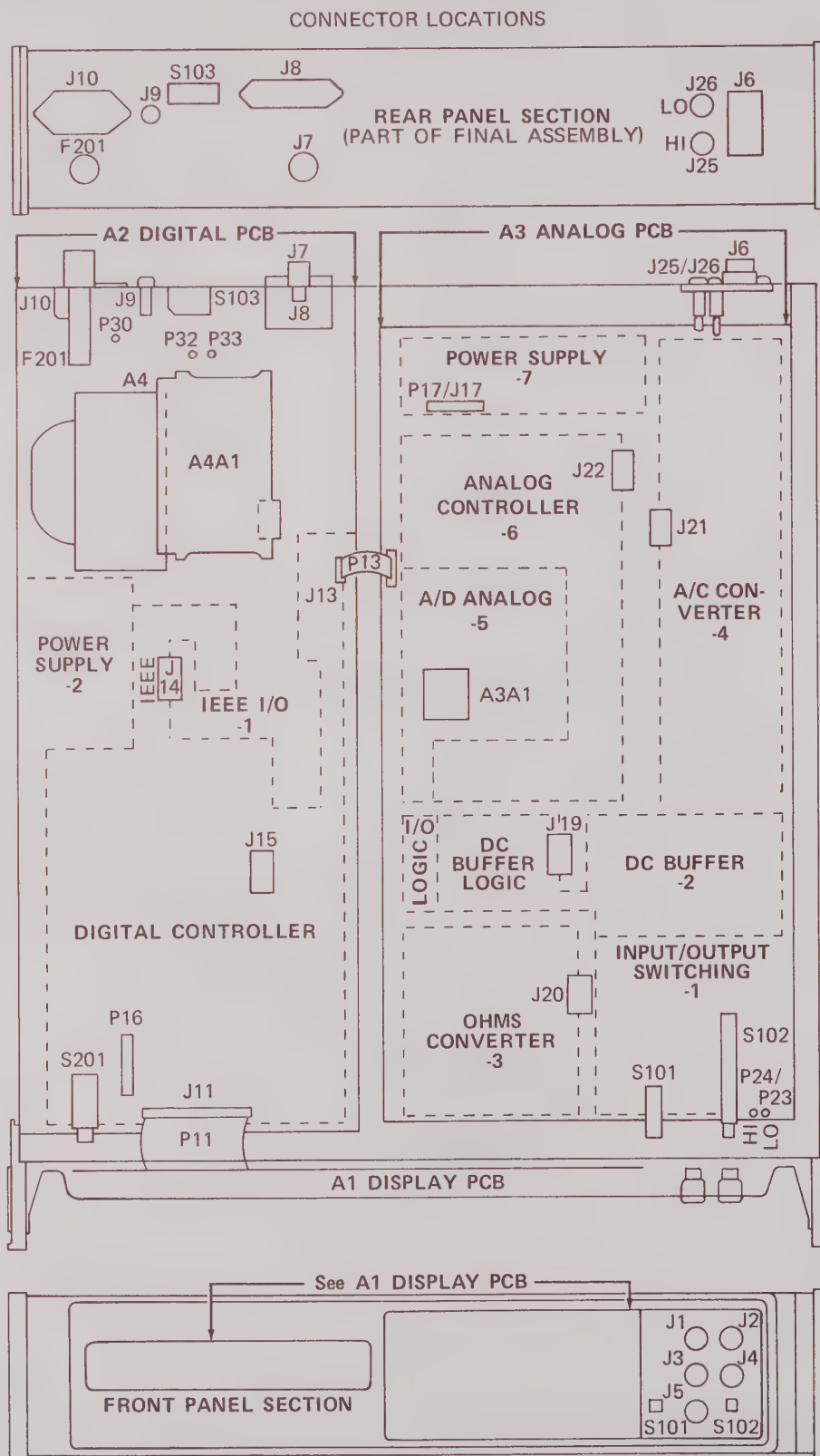
Table 6-1. 8520A Final Assembly (cont)

| REF<br>DES | DESCRIPTION                             | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|-----------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| MP22       | FUSEHOLDER, BODY & NUT (TO F201)        | 375188                | 89536               | 375188                  | 1          |            |                  |
| MP23       | FUSEHOLDER, CAP (TO F201)               | 460238                | 89536               | 460238                  | 1          |            |                  |
| MP24       | GROMMET, RUBBER                         | 100073                | 83330               | 2149                    | 1          |            |                  |
| MP25       | HANDLE, CORNER, FRONT                   | 394296                | 89536               | 394296                  | 2          |            |                  |
| MP26       | INSERT, FRONT PANEL                     | 496760                | 89536               | 496760                  | 1          |            |                  |
| MP27       | INSULATOR, FASTENER                     | 372342                | 89536               | 372342                  | 6          |            |                  |
| MP28       | LENS, DISPLAY                           | 492231                | 89536               | 492231                  | 1          |            |                  |
| MP29       | LUG, SOLDER (TO J9)                     | 101022                | 79963               | 29A                     | 2          |            |                  |
| MP30       | PANEL, FRONT                            | 491175                | 89536               | 491175                  | 1          |            |                  |
| MP31       | PANEL, REAR                             | 491076                | 89536               | 491076                  | 1          |            |                  |
| MP32       | COVERPLATE, TRANSFORMER                 | 496893                | 89536               | 496893                  | 1          |            |                  |
| MP33       | SPACER, INSULATED                       | 372334                | 89536               | 372334                  | 6          |            |                  |
| MP34       | SWITCH, ACTUATOR (TO S201)              | 502690                | 89536               | 502690                  | 1          |            |                  |
| MP35       | SIDE, LEFT GUARD                        | 490946                | 89536               | 490946                  | 1          |            |                  |
| MP36       | SIDE, RIGHT GUARD                       | 490938                | 89536               | 490938                  | 1          |            |                  |
| MP37       | PANEL, REAR GUARD                       | 490920                | 89536               | 490920                  | 1          |            |                  |
| MP38       | PANEL, FRONT GUARD                      | 490912                | 89536               | 490912                  | 1          |            |                  |
| MP39       | CABLE CLAMP                             | 100081                | 95987               | 3/8-3NA                 | 1          |            |                  |
| MP40       | DECAL, POWER ON-OFF                     | 523704                | 89536               | 523704                  | 1          |            |                  |
| MP41       | CABLE CLAMP                             | 165951                | 31827               | 3-4-1                   |            |            |                  |
| MP42       | CABLE TIE                               | 172080                | 06383               | SST-1M                  | 2          |            |                  |
| MP43       | CABLE CLAMP                             | 101352                | 71400               | 5681-15                 | 1          |            |                  |
| MP44       | DECAL, SERIALIZATION                    | 472795                | 89536               | 472795                  | 1          |            |                  |
| S201       | SWITCH, POWER                           | 507871                | 89536               | 507871                  | 1          |            |                  |
| TM1        | INSTRUCTION MANUAL, 8520A               | 504118                | 89536               | 504118                  | 1          |            |                  |
| W1         | CORD SET, 3-WIRE (NOT SHOWN)            | 284174                | 89536               | 284174                  | 1          |            |                  |
| W2         | CABLE, POWER SWITCH                     | 496877                | 89536               | 496877                  | 1          |            |                  |
|            | RECOMMENDED SPARE PARTS LIST/KIT, 8520A | 541854                | 89536               | 541854                  |            | AR         |                  |



8520A-T+B

Figure 6-1. 8520A Final Assembly



8520A-1303

Figure 6-1. 8520A Final Assembly (cont)



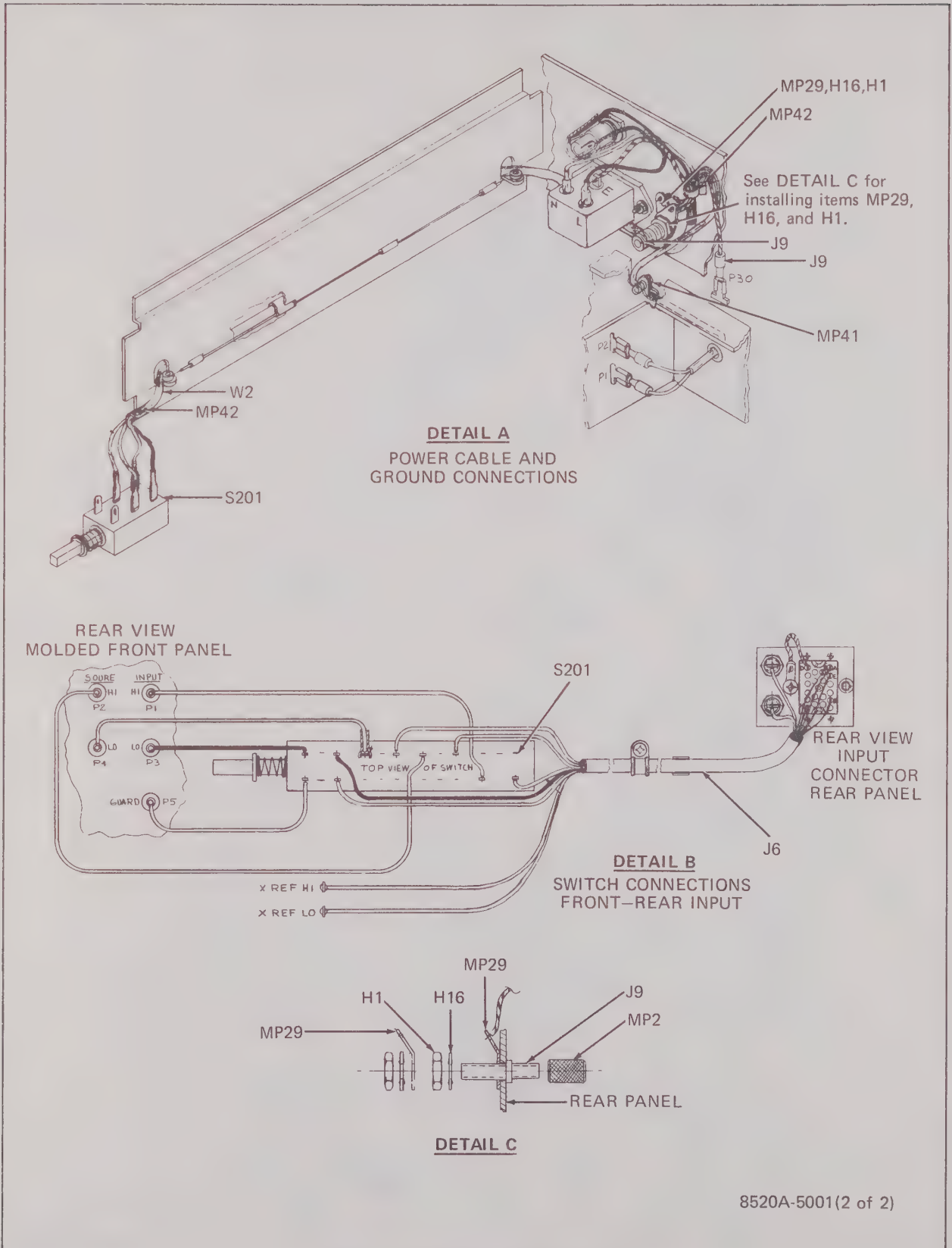
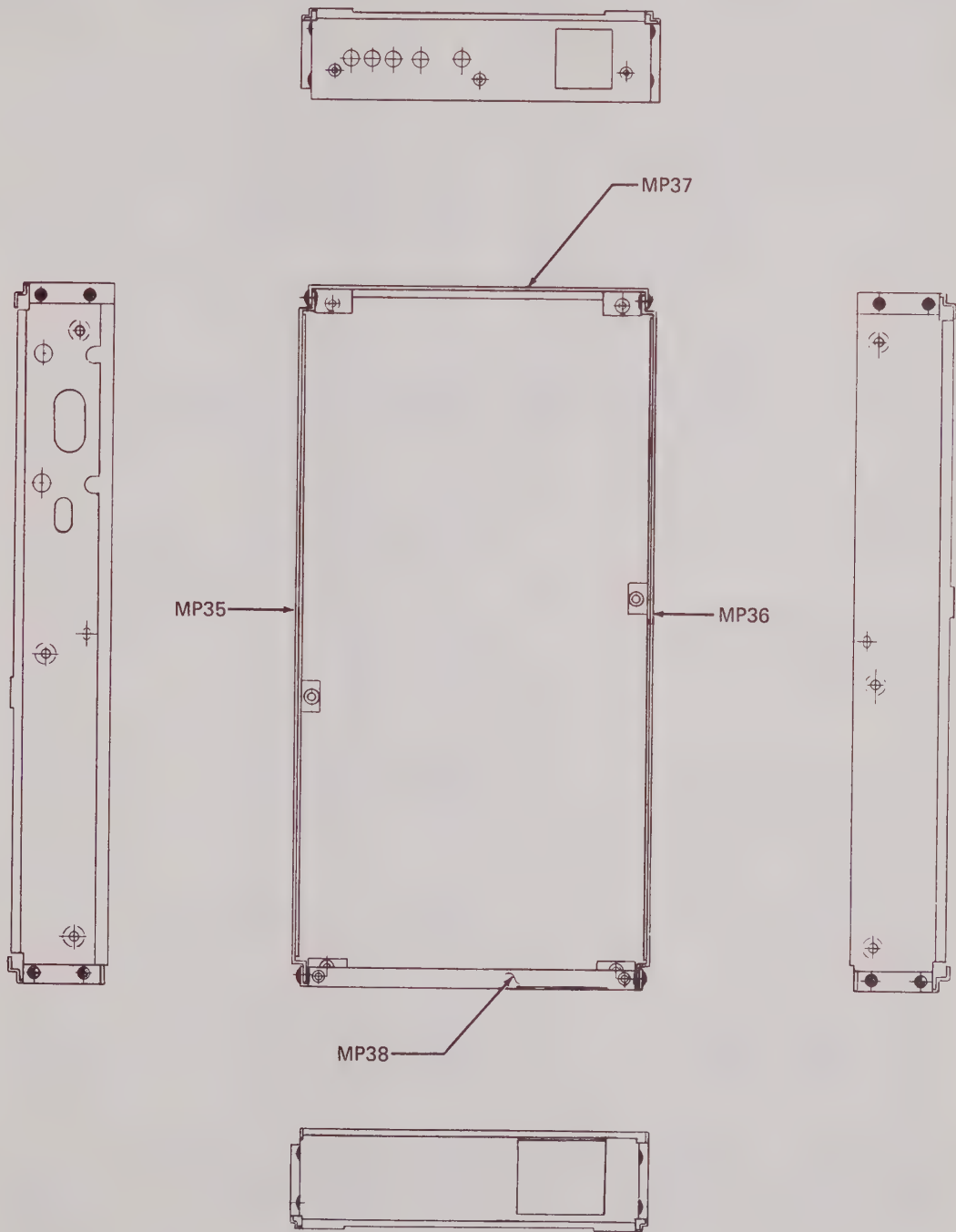


Figure 6-1. 8520A Final Assembly (cont)



8520A-2701

**Figure 6-1. 8520A Final Assembly (cont)**

Table 6-2. A1 Display PCB Assembly

| REF<br>DES | DESCRIPTION                                              | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|----------------------------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| A1         | ⊙ DISPLAY PCB ASSEMBLY<br>FIGURE 6-2 (8520A-4011T)       | 516625                | 89536               | 516625                  | REF        |            |                  |
| CR1        | DIODE, ZENER, 3.9V                                       | 113316                | 07910               | 1N748Z                  | 1          | 1          |                  |
| CR2        | DIODE, SI, HI-SPEED SWITCHING                            | 203323                | 07910               | 1N4448                  | 1          | 1          |                  |
| DS7        | LIGHT EMITTING DIODE                                     | 504761                | 29083               | MV57124                 | 1          | 1          |                  |
| J1         | CABLE                                                    | 500975                | 89536               | 500975                  | 1          |            |                  |
| MP1        | PUSHBUTTON, GRAY (TO S1-S3, S5, S8-S10,<br>S16, S18-S24) | 401307                | 89536               | 401307                  | 15         |            |                  |
| MP2        | PUSHBUTTON, BLUE (TO S7)                                 | 406736                | 89536               | 406736                  | 1          |            |                  |
| MP3        | PUSHBUTTON (TO S12,S13)                                  | 531525                | 89536               | 521525                  | 2          |            |                  |
| MP4        | SPACER, DIODE (TO DS7)                                   | 434399                | 89536               | 434399                  | 1          |            |                  |
| R1         | RES, DEP. CAR, 270 +/-5%, 1/4W                           | 348789                | 80031               | CR251-4-5P270E          | 1          |            |                  |
| R2         | RES, DEP. CAR, 200 +/-5%, 1/4W                           | 368779                | 80031               | CR251-4-5P200E          | 1          |            |                  |
| RN1        | RESISTOR NETWORK, 2.7K, 10-PIN                           | 484303                | 89536               | 484303                  | 1          | 1          |                  |
| RN2        | RESISTOR NETWORK, 1K, 8-PIN                              | 414557                | 89536               | 414557                  | 3          | 1          |                  |
| RN3        | RESISTOR NETWORK, 430, 16-PIN                            | 484295                | 89536               | 484295                  | 2          | 1          |                  |
| RN4        | RESISTOR NETWORK, 81, 16-PIN                             | 478859                | 89536               | 478859                  | 2          | 1          |                  |
| RN6        | RES, FXD, 430, 16-PIN                                    | 484295                | 89536               | 484295                  | REF        |            |                  |
| RN7        | RESISTOR NETWORK, 1K, 8-PIN                              | 414557                | 89536               | 414557                  | REF        |            |                  |
| RN8        | RESISTOR NETWORK, 1K, 8-PIN                              | 414557                | 89536               | 414557                  | REF        |            |                  |
| RN9        | RESISTOR NETWORK, 81, 16-PIN                             | 478859                | 89536               | 478859                  | REF        |            |                  |
| S1         | SWITCH, MOMENT, VDC                                      | 507319                | 89536               | 507319                  | 18         |            |                  |
| S2         | SWITCH, MOMENT, VAC                                      | 507319                | 89536               | 507319                  | REF        |            |                  |
| S3         | SWITCH, MOMENT (OHMS, 2-T)                               | 507319                | 89536               | 507319                  | REF        |            |                  |
| S4         | SWITCH, MOMENT (OHMS 4-T)                                | 507335                | 89536               | 507335                  | 4          |            | A                |
| S5         | SWITCH, MOMENT (NS)                                      | 507319                | 89536               | 507319                  | REF        |            |                  |
| S6         | SWITCH, MOMENT (PROG IN USE)                             | 507335                | 89536               | 507335                  | REF        |            | A                |
| S7         | SWITCH, MOMENT (RESET)                                   | 507319                | 89536               | 507319                  | REF        |            |                  |
| S8         | SWITCH, MOMENT (STATUS/MENU)                             | 507319                | 89536               | 507319                  | REF        |            |                  |
| S9         | SWITCH, MOMENT (BURST SIZE)                              | 507319                | 89536               | 507319                  | REF        |            |                  |
| S10        | SWITCH, MOMENT (BURST LOC)                               | 507319                | 89536               | 507319                  | REF        |            |                  |
| S11        | SWITCH, MOMENT (AUTO RANGE)                              | 525170                | 89536               | 525170                  | 1          |            | A                |
| S12        | SWITCH, MOMENT (UP)                                      | 507319                | 89536               | 507319                  | REF        |            |                  |
| S13        | SWITCH, MOMENT (DOWN)                                    | 507319                | 89536               | 507319                  | REF        |            |                  |
| S14        | SWITCH, MOMENT (EXT/AUTO)                                | 507335                | 89536               | 507335                  | REF        |            | A                |
| S15        | SWITCH, MOMENT (ARM BNC)                                 | 507335                | 89536               | 507335                  | REF        |            | A                |
| S16        | SWITCH, MOMENT (MANUAL)                                  | 507319                | 89536               | 507319                  | REF        |            |                  |
| S17        | SWITCH, ORANGE (SHIFT)                                   | 524082                | 89536               | 524082                  | 1          |            | A                |
| S18        | SWITCH, MOMENT (MATH SEL)                                | 507319                | 89536               | 507319                  | REF        |            |                  |
| S19        | SWITCH, MOMENT (MATH DATA)                               | 507319                | 89536               | 507319                  | REF        |            |                  |
| S20        | SWITCH, MOMENT (RR FASTER)                               | 507319                | 89536               | 507319                  | REF        |            |                  |
| S21        | SWITCH, MOMENT (RR SLOWER)                               | 507319                | 89536               | 507319                  | REF        |            |                  |
| S22        | SWITCH, MOMENT (FILT FASTER)                             | 507319                | 89536               | 507319                  | REF        |            |                  |
| S23        | SWITCH, MOMENT (FILT SLOWER)                             | 507319                | 89536               | 507319                  | REF        |            |                  |
| S24        | SWITCH, MOMENT (LOCAL)                                   | 507319                | 89536               | 507319                  | REF        |            |                  |
| U1         | IC, TTL, LO-PWR, SCHTTKY, OCTAL "D" TYPE                 | 454892                | 01295               | SN74LS273N              | 1          | 1          |                  |
| U2         | IC, QUAD, COMMON EMITTER/OPEN COLLECTOR                  | 454306                | 56289               | UNL2064B                | 2          | 1          |                  |
| U3         | IC, QUAD, COMMON EMITTER/OPEN COLLECTOR                  | 454306                | 56289               | UNL2064B                | REF        |            |                  |
| U5         | ⊙ IC, C-MOS, HEX OPEN DRAIN BUFFERS                      | 473389                | 12040               | MM74C906N               | 2          | 1          |                  |

Table 6-2. A1 Display PCB Assembly (cont)

| REF<br>DES                                                                                                                                                            | DESCRIPTION                                | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| U6                                                                                                                                                                    | ⊗ IC, C-MOS, TRI-STATE, HEX NON-INV BFFRS  | 407759                | 12040               | MM80C97N                | 1          | 1          |                  |
| U7                                                                                                                                                                    | ⊗ IC, C-MOS, HEX OPEN DRAIN BUFFERS        | 473389                | 12040               | MM74C906N               | REF        |            |                  |
| U9                                                                                                                                                                    | ⊗ IC, C-MOS 8-BIT ADDRESSABLE LATCH 16-PIN | 453258                | 02735               | CD4099BE                | 2          | 1          |                  |
| U10                                                                                                                                                                   | IC, LIN, ARRAY, QUAD, PNP, XSTR            | 477828                | 12040               | DH3467CN                | 4          | 1          |                  |
| U11                                                                                                                                                                   | IC, LIN, ARRAY, QUAD, PNP, XSTR            | 477828                | 12040               | DH3467CN                | REF        |            |                  |
| U12                                                                                                                                                                   | ⊗ IC, C-MOS 8-BIT ADDRESSABLE LATCH 16-PIN | 453258                | 02735               | CD4099BE                | REF        |            |                  |
| U13                                                                                                                                                                   | IC, MATCHED SET                            | 581363                | 29083               | 518363                  | 1          | 1          |                  |
| U14                                                                                                                                                                   | IC, PART OF U13 SET                        | 518363                | 29083               | 518363                  | REF        |            |                  |
| U15                                                                                                                                                                   | IC, PART OF U13 SET                        | 581363                | 29083               | 581363                  | REF        |            |                  |
| U19                                                                                                                                                                   | IC, DISPLAY, LED                           | 478065                | 50579               | DL02614                 | 2          | 1          |                  |
| U20                                                                                                                                                                   | IC, DISPLAY, LED                           | 478065                | 50579               | DL02614                 | REF        |            |                  |
| U21                                                                                                                                                                   | IC, LIN, NPN XSTR ARRAY 16-PIN DIP         | 407866                | 49671               | CA3081                  | 2          | 1          |                  |
| U22                                                                                                                                                                   | IC, LIN, NPN XSTR ARRAY 16-PIN DIP         | 407866                | 49671               | CA3081                  | REF        |            |                  |
| U23                                                                                                                                                                   | IC, LIN, ARRAY, QUAD, PNP, XSTR            | 477828                | 12040               | DH3467CN                | REF        |            |                  |
| U24                                                                                                                                                                   | IC, LIN, ARRAY, QUAD, PNP, XSTR            | 477828                | 12040               | DH3467CN                | REF        |            |                  |
| <p>A THE DIODES IN THESE SWITCHES<br/>CANNOT BE REPLACED. ORDER AS<br/>A COMPLETE UNIT. THE SWITCH<br/>COMES COMPLETE WITH DIODE AND<br/>BUTTON. (DS-5,3,2,4,6,8)</p> |                                            |                       |                     |                         |            |            |                  |

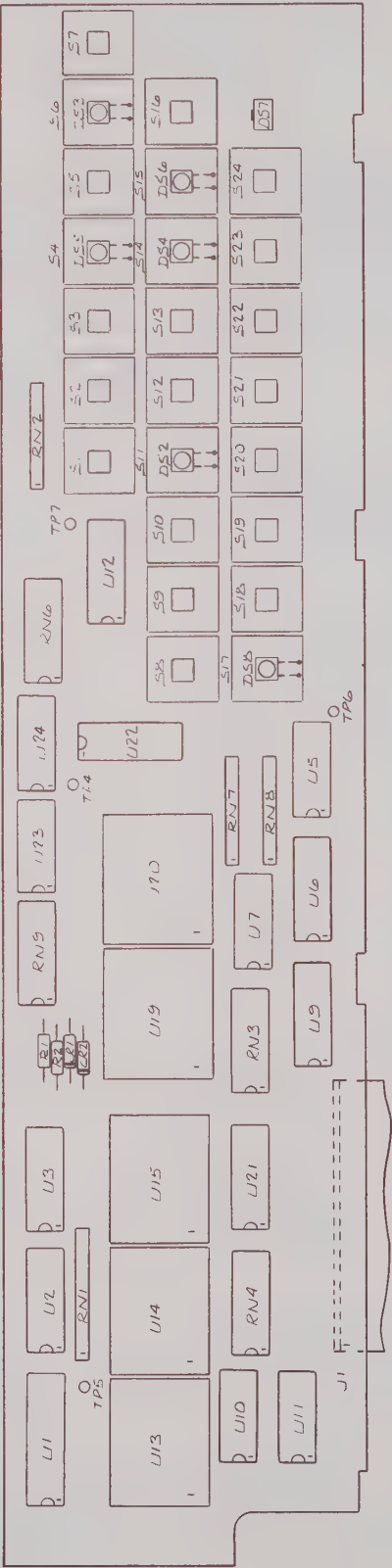


Figure 6-2. A1 Display PCB Assembly

Table 6-3. A2 Digital (Controller) PCB Assembly

| REF<br>DES | DESCRIPTION                                                     | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | NOTE |
|------------|-----------------------------------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------|
| A2         | ⊗ DIGITAL (CONTROLLER) PCB ASSEMBLY<br>FIGURE 6-3 (8520A-4020T) | 496828                | 89536               | 496828                  | REF        |            | A    |
| C1         | CAP, TA, 10 UF +/-20%, 10V                                      | 176214                | 56289               | 196D106X0010KA1         | 1          |            |      |
| C2         | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | 24         |            |      |
| C3         | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C4         | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C5         | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C6         | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C7         | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C8         | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C9         | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C10        | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C11        | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C12        | CAP, TA, 22 UF +/-20%, 15V                                      | 423012                | 56289               | 196D226X0015KA1         | 2          |            |      |
| C13        | CAP, MICA, 47 PF +/-5%, 500V                                    | 148536                | 72136               | DM15E470J               | 1          |            |      |
| C14        | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C15        | CAP, CER, .05 UF -20/+80%, 25V                                  | 148924                | 72982               | 5855-000-Y5U0-503Z      | 1          |            |      |
| C16        | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C17        | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C18        | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C19        | CAP, FXD, .01 UF +/-20%, 100V                                   | 407361                | 72982               | 8121-A100-W5R-103M      | 2          |            |      |
| C20        | CAP, TA, 1 UF +/-20%, 35V                                       | 161919                | 56289               | 196D105X0020JA1         | 4          |            |      |
| C21        | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C22        | CAP, FXD, .01 UF +/-20%, 100V                                   | 407361                | 72982               | 8121-A100-W5R-103M      | REF        |            |      |
| C23        | CAP, TA, 39 UF +/-20%, 6V                                       | 163915                | 56289               | 196D396X006KA1          | 1          |            |      |
| C24        | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C25        | CAP, MICA, 100 PF +/-5%, 500V                                   | 148494                | 72136               | DM15F101J               | 3          |            |      |
| C26        | CAP, MICA, 100 PF +/-5%, 500V                                   | 148494                | 72136               | DM15F101J               | REF        |            |      |
| C27        | CAP, TA, 1 UF +/-20%, 35V                                       | 161919                | 56289               | 196D105X0020JA1         | REF        |            |      |
| C28        | CAP, TA, 1 UF +/-20%, 35V                                       | 161919                | 56289               | 196D105X0020JA1         | REF        |            |      |
| C29        | CAP, TA, 10 UF +/-20%, 15V                                      | 193623                | 56289               | 196D106X0015A1          | 2          |            |      |
| C30        | CAP, TA, 1 UF +/-20%, 35V                                       | 161919                | 56289               | 196D105X0020JA1         | REF        |            |      |
| C31        | CAP, MICA, 100 PF +/-5%, 500V                                   | 148494                | 72136               | DM15F101J               | REF        |            |      |
| C101       | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C102       | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C103       | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C104       | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C105       | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C106       | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C107       | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C108       | CAP, CER, 0.025 UF +/-20%, 100V                                 | 168435                | 56289               | C023B101H253M           | REF        |            |      |
| C201       | CAP, ELEC, 22,000 UF, 15/18V                                    | 479220                | 90201               | CGS223U015V2C3PL        | 1          |            |      |
| C202       | CAP, TA, 0.22 UF +/-20%, 35V                                    | 161331                | 56289               | 196D224X0035HA1         | 1          |            |      |
| C203       | CAP, TA, 10 UF +/-20%, 15V                                      | 193623                | 56289               | 196D106X0015A1          | REF        |            |      |
| C204       | CAP, TA, 22 UF +/-20%, 15V                                      | 423012                | 56289               | 196D226X0015KA1         | REF        |            |      |
| CR1        | DIODE, SI, HI-SPEED SWITCHING                                   | 203323                | 07910               | 1N4448                  | 3          | 1          |      |
| CR2        | DIODE, SI, HI-SPEED SWITCHING                                   | 203323                | 07910               | 1N4448                  | REF        |            |      |
| CR3        | DIODE, SI, HI-SPEED SWITCHING                                   | 203323                | 07910               | 1N4448                  | REF        |            |      |
| CR201      | DIODE, LIGHT EMITTING (LED)                                     | 429555                | 12040               | NSL5058/NSC003          | 1          | 1          |      |

Table 6-3. A2 Digital (Controller) PCB Assembly (cont)

| REF<br>DES | DESCRIPTION                           | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|---------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| CR202      | DIODE, SI                             | 343491                | 04713               | 1N4002                  | 2          | 1          |                  |
| CR203      | DIODE, SI                             | 343491                | 04713               | 1N4002                  | REF        |            |                  |
| H1         | SCREW, 4-40 X 7/16                    | 403782                | 89536               | 403782                  | 1          |            |                  |
| H2         | SCREW, 4-40 X 5/16 (NOT SHOWN)        | 335141                | 89536               | 335141                  | 1          |            |                  |
| H3         | SCREW, 10-31 X 5/16                   | 417105                | 89536               | 417105                  | 2          |            |                  |
| H4         | SCREW, 5-20 X 5/16, THD/FORM          | 494641                | 78189               | 03-050500-01-0255CT     | 2          |            |                  |
| H5         | WASHER, SHOULDER                      | 436386                | 89536               | 436386                  | 1          |            |                  |
| J8         | CONN, RECEPT.                         | 485763                | 00779               | 552791-2                | 1          |            |                  |
| J11        | SOCKET, SIP, 20-PIN                   | 443077                | 00779               | 1-583773-2              | 1          |            |                  |
| J12        | CONN, EDGE, 4-POS, 8-CONT, 3A, 500V   | 354951                | 00779               | 583407-5                | 1          |            |                  |
| J13        | SOCKET, 4-PIN                         | 461756                | 00779               | 583773-1                | 1          |            |                  |
| J14        | PROGRAMMED HEADER                     | 495507                | 89536               | 495507                  | 1          |            |                  |
| J16        | CONN, PLUG, 11-PIN                    | 494666                | 00779               | 1-640456-1              | 1          |            |                  |
| L1         | CHOKE, 6-TURN                         | 320911                | 89536               | 320911                  | 1          |            |                  |
| MP1        | BRACKET, CAP REG.                     | 490490                | 89536               | 490490                  | 1          |            |                  |
| MP2        | KEYING, PLUG, AMP (NOT SHOWN)         | 424572                | 89536               | 424572                  | 1          |            |                  |
| MP3        | GROMMET, NYLON                        | 102277                | 89536               | 102277                  | .2         |            |                  |
| MP4        | STRAP, NYLON                          | 501734                | 06383               | SST-35                  | 1          |            |                  |
| MP5        | INSULATOR                             | 508630                | 89536               | 508630                  | 1          |            |                  |
| MP6        | PAD, CRYSTAL (TO Y1) (NOT SHOWN)      | 296319                | 89536               | 296319                  | 2          |            |                  |
| P30        | AMP BLADES (CONN)<br>* SEE TP'S TOTAL | 512889                | 89536               | USED ALSO AS TP'S       | *          |            |                  |
| P32        | AMP BLADES (CONN)                     | 512889                | 89536               | USED ALSO AS TP'S       | REF        |            |                  |
| P33        | AMP BLADES (CONN)                     | 512889                | 89536               | USED ALSO AS TP'S       | REF        |            |                  |
| P201       | CONNECTING LINK (NOT SHOWN)           | 523167                | 89536               | 523167                  | 1          |            |                  |
| R1         | RES, DEP. CAR, 1K +/-5%, 1/4W         | 343426                | 80031               | CR251-4-5P1K            | 8          |            |                  |
| R2         | RES, DEP. CAR, 1K +/-5%, 1/4W         | 343426                | 80031               | CR251-4-5P1K            | REF        |            |                  |
| R4         | RES, DEP. CAR, 1K +/-5%, 1/4W         | 343426                | 80031               | CR251-4-5P1K            | REF        |            |                  |
| R5         | RES, DEP. CAR, 1K +/-5%, 1/4W         | 343426                | 80031               | CR251-4-5P1K            | REF        |            |                  |
| R6         | RES, COMP, 150 +/-5%, 1/4W            | 343442                | 01121               | CB1515                  | 1          |            |                  |
| R7         | RES, DEP. CAR, 51 +/-5%, 1/4W         | 414540                | 80031               | CR251-4-5P51E           | 3          |            |                  |
| R8         | RES, DEP. CAR, 1K +/-5%, 1/4W         | 343426                | 80031               | CR251-4-5P1K            | REF        |            |                  |
| R9         | RES, DEP. CAR, 10K +/-5%, 1/4W        | 348839                | 80031               | CR251-4-5P10K           | 5          |            |                  |
| R10        | RES, MTL. FILM, 100K +/-1%, 1/8W      | 248807                | 91637               | CMF551003F              | 1          |            |                  |
| R11        | RES, MTL. FILM, 681K +/-1%, 1/8W      | 381517                | 91637               | CMF556813F              | 1          |            |                  |
| R12        | RES, MTL. FILM, 1.5K +/-1%, 1/8W      | 313098                | 91637               | CMF551501F              | 1          |            |                  |
| R13        | RES, MTL. FILM, 10K, +/-1%, 1/8W      | 168260                | 91637               | CMF551002F              | 1          |            |                  |
| R14        | RES, DEP. CAR, 1K +/-5%, 1/4W         | 343426                | 80031               | CR251-4-5P1K            | REF        |            |                  |
| R15        | RES, DEP. CAR, 1K +/-5%, 1/4W         | 343426                | 80031               | CR251-4-5P1K            | REF        |            |                  |
| R16        | RES, DEP. CAR, 10K +/-5%, 1/4W        | 348839                | 80031               | CR251-4-5P10K           | REF        |            |                  |
| R17        | RES, DEP. CAR, 100K +/-5%, 1/4W       | 348920                | 80031               | CR251-4-5P100K          | 1          |            |                  |
| R18        | RES, MTL. FILM, 28.0K +/-1%, 1/8W     | 291385                | 91637               | CMF552802F              | 1          |            |                  |
| R19        | RES, DEP. CAR, 10K +/-5%, 1/4W        | 348839                | 80031               | CR251-4-5P10K           | REF        |            |                  |
| R21        | RES, MTL. FILM, 82.5K +/-1%, 1/8W     | 246223                | 91637               | CMF558252F              | 1          |            |                  |
| R23        | RES, DEP. CAR, 51 +/-5%, 1/4W         | 414540                | 80031               | CR251-4-5P51E           | REF        |            |                  |
| R24        | RES, DEP. CAR, 51 +/-5%, 1/4W         | 414540                | 80031               | CR251-4-5P51E           | REF        |            |                  |
| R25        | RES, DEP. CAR, 820 +/-5%, 1/4W        | 442327                | 80031               | CR251-4-5P820E          | 1          |            |                  |
| R26        | RES, DEP. CAR, 1K +/-5%, 1/4W         | 343426                | 80031               | CR251-4-5P1K            | REF        |            |                  |
| R27        | RES, DEP. CAR, 1.2K +/-5%, 1/4W       | 441378                | 80031               | CR251-4-5P1K2           | 1          |            |                  |
| R101       | RES, DEP. CAR, 10K +/-5%, 1/4W        | 348839                | 80031               | CR251-4-5P10K           | REF        |            |                  |

Table 6-3. A2 Digital (Controller) PCB Assembly (cont)

| REF<br>DES | DESCRIPTION                               | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|-------------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| R102       | RES, DEP. CAR, 10K +/-5%, 1/4W            | 348839                | 80031               | CR251-4-5P10K           | REF        |            |                  |
| R104       | RES, DEP. CAR, 100 +/-5%, 1/4W            | 348771                | 80031               | CR251-4-5P100E          | 1          |            |                  |
| R201       | RES, WW, 1 OHM +/-10%, 2W                 | 485672                | 89536               | 485672                  | 1          |            |                  |
| R202       | RES, MTL. FILM, 249 +/-1%, 1/8W           | 448043                | 91637               | CMF552490F              | 1          |            |                  |
| R203       | RES, MTL. FILM, 649 +/-1%, 1/8W           | 309955                | 91637               | CMF556490F              | 1          |            |                  |
| R204       | RES, CERM, 200 +/-10%, 1/2W               | 275743                | 89536               | 275743                  | 1          |            |                  |
| R205       | RES, DEP. CAR, 390 +/-5%, 1/4W            | 441543                | 80031               | CR251-4-5P390E          | 1          |            |                  |
| R209       | RES, COMP, 10K +/-10%, 1/2W               | 108118                | 01121               | EB1031                  | 1          |            |                  |
| R210       | RES, WW, 13, 5W                           | 520197                | 89536               | 520197                  | 1          |            |                  |
| RN1        | RES, NETWORK, 10K, 10-PIN                 | 414003                | 89536               | 414003                  | 2          |            |                  |
| RN2        | RES, NETWORK, 10K, 16-PIN                 | 355305                | 89536               | 355305                  | 1          |            |                  |
| RN101      | RES, NETWORK, 10K, 10-PIN                 | 414003                | 89536               | 414003                  | REF        |            |                  |
| S1         | SWITCH, SHADOW                            | 507319                | 89536               | 507319                  | 1          |            |                  |
| S103       | SWITCH, DIP, 8-POS.                       | 495168                | 00779               | 435802-1                | 1          |            |                  |
| TP'S       | TEST POINTS AND/OR CONNECTIONS            | 512889                | 89536               | 512889                  | 18         |            |                  |
| U1         | ⊗ IC, C-MOS, 74C, DUAL "D" TYPE F/F       | 418830                | 12040               | MM74C74                 | 2          | 1          |                  |
| U2         | IC, TTL, LO-PWR, 3-8 LINE DECODER         | 407585                | 01295               | SN74LS138N              | 2          | 1          |                  |
| U3         | IC, TTL, LO-PWR, 3-8 LINE DECODER         | 407585                | 01295               | SN74LS138N              | REF        |            |                  |
| U6         | ⊗ IC, MOS, SI, N-CHAN, GATE               | 472902                | 34649               | P2114L                  | 2          | 1          |                  |
| U7         | ⊗ IC, MOS, SI, N-CHAN, GATE               | 472902                | 34649               | P2114L                  | REF        |            |                  |
| U8         | IC, TTL, LO-PWR, SCHOTTKY, OCT/D-F/F      | 454892                | 01295               | SN74LS273N              | 1          | 1          |                  |
| U9         | IC, TTL, DUAL, "D" TYPE CLEAR AND PRESET  | 393124                | 01295               | SN74LS74N               | 3          | 1          |                  |
| U10        | ⊗ IC, MOS, ROM                            | 524439                | 89536               | 524439                  | 1          | 1          |                  |
| U11        | ⊗ IC, MOS, ROM                            | 524462                | 89536               | 524462                  | 1          | 1          |                  |
| U12        | ⊗ IC, MOS, ROM                            | 524470                | 89536               | 524470                  | 1          | 1          |                  |
| U16        | IC, TTL, QUAD, 2-INPUT, POS NAND GATE     | 393033                | 01295               | SN74LS00N               | 1          | 1          |                  |
| U17        | IC, TTL, HEX INVERTER, OPEN COLLECTOR     | 394536                | 01295               | SN74LS05N               | 1          | 1          |                  |
| U18        | ⊗ IC, MOS, SI, GATE N-CHAN, 8-BIT         | 478073                | 50088               | MK3880-4CPU             | 1          | 1          |                  |
| U19        | IC, TTL, HEX, INVERTER                    | 292979                | 01295               | SN7404N                 | 1          | 1          |                  |
| U20        | IC, TTL, SYNCHRONOUS COUNTERS             | 495598                | 01295               | SN74LS163N              | 1          | 1          |                  |
| U21        | ⊗ IC, C-MOS, DUAL UP COUNTER              | 355164                | 04713               | MC14520CL/CP            | 2          | 1          |                  |
| U22        | ⊗ IC, C-MOS, DUAL, "D" TYPE, F/F          | 340117                | 02735               | CD4013AE                | 1          | 1          |                  |
| U23        | ⊗ IC, C-MOS, QUAD, 2-IN NAND SMITT/TRIG   | 404632                | 02735               | CD4093BE                | 1          | 1          |                  |
| U24        | IC, TTL, OCT BUS TRNSCVRS W/3-ST OUT      | 477406                | 01295               | SN74LS245N              | 1          | 1          |                  |
| U25        | IC, TTL, MIS, 4-16 LINE DECODE/DEMTIPLXRS | 293217                | 01295               | SN74154N                | 1          | 1          |                  |
| U26        | ⊗ IC, C-MOS, ASYNCRNS, REC/TRANSMITTER    | 453464                | 32293               | IM6402CPL               | 1          | 1          |                  |
| U27        | ⊗ IC, C-MOS, TRI-ST, HEX NO-INVRT BUFFS   | 407759                | 12040               | MM80C97N                | 2          | 1          |                  |
| U28        | ⊗ IC, C-MOS, DUAL UP COUNTER              | 355164                | 04713               | MC14520CL/CP            | REF        |            |                  |
| U29        | IC, LIN, C-MOS, PHASE LOCKED LOOP         | 403584                | 02735               | CD4046AE                | 1          | 1          |                  |
| U30        | IC, POS NOR GATES, TOTEM POLE OUTPUTS     | 393041                | 01295               | SN74LS02N               | 1          | 1          |                  |
| U31        | ⊗ IC, C-MOS, TRI-ST, HEX NO-INVRT BUFFS   | 407759                | 12040               | MM80C97N                | REF        |            |                  |
| U32        | ⊗ IC, C-MOS, PRESET DIV-BY-N-CNTR         | 478313                | 02735               | CD4018BE                | 1          | 1          |                  |
| U33        | IC, TTL, QUAD, 2-INPUT, POS AND GATES     | 393066                | 01295               | SN74LS08N               | 1          | 1          |                  |
| U34        | IC, TTL, POS NAND GATES, HEX INVERTERS    | 393058                | 01295               | SN74LS04N               | 2          | 1          |                  |
| U35        | ⊗ IC, C-MOS, 74C, DUAL "D" TYPE F/F       | 418830                | 12040               | MM74C74                 | REF        |            |                  |
| U36        | IC, TTL, LO-PWR, SNGL/DUAL RETRIG         | 404186                | 01295               | SN74LS123N              | 1          | 1          |                  |
| U37        | IC, TTL, DUAL PERIPHERAL DRIVER           | 329706                | 01295               | SN75452P                | 1          | 1          |                  |
| U38        | IC, PULSE TRANSFORMER                     | 509141                | 89536               | 509141                  | 1          | 1          |                  |
| U39        | IC, TTL, SCHMT/TRIG POSNAND GATE W/TP OUT | 504449                | 01295               | SN74LS132N              | 1          | 1          |                  |
| U101       | ⊗ IC, MOS, N-CHANNEL, SI, GATE            | 477794                | 04713               | MC68488P                | 1          | 1          |                  |

Table 6-3. A2 Digital (Controller) PCB Assembly (cont)

| REF<br>DES | DESCRIPTION                                | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|--------------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| U102       | IC, TTL, LO-PWR SCHOTTKY, TRI-ST, OCT/BUFF | 429902                | 12040               | DM81LS95N               | 1          | 1          |                  |
| U103       | IC, TTL, DUAL, "D" TYPE CLEAR AND PRESET   | 393124                | 01295               | SN74LS74N               | REF        |            |                  |
| U104       | IC, TTL, QUAD, 2-IN POS OR GATE            | 393108                | 01295               | SN74LS32N               | 1          | 1          |                  |
| U105       | IC, TTL, DUAL, "D" TYPE CLEAR AND PRESET   | 393124                | 01295               | SN74LS74N               | REF        |            |                  |
| U106       | IC, TTL, POS NAND GATES, HEX INVERTERS     | 393058                | 01295               | SN74LS04N               | REF        |            |                  |
| U107       | IC, QUAD, INTERFACE BUS TRANSCEIVER        | 428649                | 04713               | MC3446P                 | 1          | 1          |                  |
| U108       | IC, QUAD, 3-ST BUS TRANSCEIVER             | 453480                | 04713               | MC3448P                 | 3          | 1          |                  |
| U109       | IC, QUAD, 3-ST BUS TRANSCEIVER             | 453480                | 04713               | MC3448P                 | REF        |            |                  |
| U110       | IC, QUAD, 3-ST BUS TRANSCEIVER             | 453480                | 04713               | MC3448P                 | REF        |            |                  |
| U202       | IC, LIN, ADJ VOLT REGULATOR, 5V            | 460410                | 12040               | LM317T                  | 1          | 1          |                  |
| XJ11       | (SAME AS J11)                              |                       |                     |                         |            |            |                  |
| XJ13       | (SAME AS J13)                              |                       |                     |                         |            |            |                  |
| XJ14       | SOCKET, IC, 16-PIN                         | 370312                | 91506               | 316-AG39D               | 17         |            |                  |
| XJ15       | SOCKET, IC, 16-PIN                         | 370312                | 91506               | 316-AG39D               | REF        |            |                  |
| XJ201      | SOCKET, 5-PIN                              | 417899                | 89536               | 417899                  | 1          |            |                  |
| XU1        | SOCKET, IC, 14-PIN                         | 370304                | 12040               | MM74C906N               | 16         |            |                  |
| XU2        | SOCKET, 16-PIN                             | 370312                | 91506               | 316-AG39D               | REF        |            |                  |
| XU3        | SOCKET, 16-PIN                             | 370312                | 91506               | 316-AG39D               | REF        |            |                  |
| XU4        | SOCKET, IC, 18-PIN                         | 418228                | 91506               | 318-AG39D               | 4          |            |                  |
| XU5        | SOCKET, IC, 18-PIN                         | 418228                | 91506               | 318-AG39D               | REF        |            |                  |
| XU6        | SOCKET, IC, 18-PIN                         | 418228                | 91506               | 318-AG39D               | REF        |            |                  |
| XU7        | SOCKET, IC, 18-PIN                         | 418228                | 91506               | 318-AG39D               | REF        |            |                  |
| XU8        | SOCKET, IC, 20-PIN                         | 454421                | 91506               | 320-AG39D               | 3          |            |                  |
| XU9        | SOCKET, IC, 14-PIN                         | 370304                | 12040               | MM74C906N               | REF        |            |                  |
| XU10       | SOCKET, IC, 24-PIN                         | 418970                | 91506               | 324-AG39D               | 6          |            |                  |
| XU11       | SOCKET, IC, 24-PIN                         | 418970                | 91506               | 324-AG39D               | REF        |            |                  |
| XU12       | SOCKET, IC, 24-PIN                         | 418970                | 91506               | 324-AG39D               | REF        |            |                  |
| XU13       | SOCKET, IC, 24-PIN                         | 418970                | 91506               | 324-AG39D               | REF        |            |                  |
| XU14       | SOCKET, IC, 24-PIN                         | 418970                | 91506               | 324-AG39D               | REF        |            |                  |
| XU16       | SOCKET, IC, 14-PIN                         | 370304                | 12040               | MM74C906N               | REF        |            |                  |
| XU17       | SOCKET, IC, 14-PIN                         | 370304                | 12040               | MM74C906N               | REF        |            |                  |
| XU18       | SOCKET, IC, 40-PIN                         | 418988                | 91506               | 340-AG39D               | 3          |            |                  |
| XU19       | SOCKET, IC, 14-PIN                         | 370304                | 12040               | MM74C906N               | REF        |            |                  |
| XU20       | SOCKET, IC, 16-PIN                         | 370312                | 91506               | 316-AG39D               | REF        |            |                  |
| XU21       | SOCKET, IC, 16-PIN                         | 370312                | 91506               | 316-AG39D               | REF        |            |                  |
| XU22       | SOCKET, IC, 14-PIN                         | 370304                | 12040               | MM74C906N               | REF        |            |                  |
| XU23       | SOCKET, IC, 14-PIN                         | 370304                | 12040               | MM74C906N               | REF        |            |                  |
| XU24       | SOCKET, IC, 20-PIN                         | 454421                | 91506               | 320-AG39D               | REF        |            |                  |
| XU25       | SOCKET, IC, 24-PIN                         | 418970                | 91506               | 324-AG39D               | REF        |            |                  |
| XU26       | SOCKET, IC, 40-PIN                         | 418988                | 91506               | 340-AG39D               | REF        |            |                  |
| XU27       | SOCKET, IC, 16-PIN                         | 370312                | 91506               | 316-AG39D               | REF        |            |                  |
| XU28       | SOCKET, IC, 16-PIN                         | 370312                | 91506               | 316-AG39D               | REF        |            |                  |
| XU29       | SOCKET, IC, 16-PIN                         | 370312                | 91506               | 316-AG39D               | REF        |            |                  |
| XU30       | SOCKET, IC, 14-PIN                         | 370304                | 12040               | MM74C906N               | REF        |            |                  |
| XU31       | SOCKET, IC, 16-PIN                         | 370312                | 91506               | 316-AG39D               | REF        |            |                  |
| XU32       | SOCKET, IC, 16-PIN                         | 370312                | 91506               | 316-AG39D               | REF        |            |                  |
| XU33       | SOCKET, IC, 14-PIN                         | 370304                | 12040               | MM74C906N               | REF        |            |                  |
| XU34       | SOCKET, IC, 14-PIN                         | 370304                | 12040               | MM74C906N               | REF        |            |                  |
| XU35       | SOCKET, IC, 14-PIN                         | 370304                | 12040               | MM74C906N               | REF        |            |                  |
| XU36       | SOCKET, IC, 16-PIN                         | 370312                | 91506               | 316-AG39D               | REF        |            |                  |

Table 6-3. A2 Digital (Controller) PCB Assembly (cont)

| REF<br>DES | DESCRIPTION            | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| XU37       | SOCKET, IC, 8-PIN      | 478016                | 91506               | 308-AG39D               | 1          |            |                  |
| XU38       | SOCKET, IC, 16-PIN     | 370312                | 91506               | 316-AG39D               | REF        |            |                  |
| XU39       | SOCKET, IC, 14-PIN     | 370304                | 12040               | MM74C906N               | REF        |            |                  |
| XU101      | SOCKET, IC, 40-PIN     | 418988                | 91506               | 340-AG39D               | REF        |            |                  |
| XU102      | SOCKET, IC, 20-PIN     | 454421                | 91506               | 320-AG39D               | REF        |            |                  |
| XU103      | SOCKET, IC, 14-PIN     | 370304                | 12040               | MM74C906N               | REF        |            |                  |
| XU104      | SOCKET, IC, 14-PIN     | 370304                | 12040               | MM74C906N               | REF        |            |                  |
| XU105      | SOCKET, IC, 14-PIN     | 370304                | 12040               | MM74C906N               | REF        |            |                  |
| XU106      | SOCKET, IC, 14-PIN     | 370304                | 12040               | MM74C906N               | REF        |            |                  |
| XU107      | SOCKET, IC, 16-PIN     | 370312                | 91506               | 316-AG39D               | REF        |            |                  |
| XU108      | SOCKET, IC, 16-PIN     | 370312                | 91506               | 316-AG39D               | REF        |            |                  |
| XU109      | SOCKET, IC, 16-PIN     | 370312                | 91506               | 316-AG39D               | REF        |            |                  |
| XU110      | SOCKET, IC, 16-PIN     | 370312                | 91506               | 316-AG39D               | REF        |            |                  |
| Y1         | CRYSTAL, QUARTZ, 8-MHZ | 485060                | 89536               | 485060                  | 1          | 1          |                  |

## A REFERENCE DESIGNATOR CODES:

100 SERIES IEEE I/O SECTION AND SWITCH  
(EX: U106 WILL BE FOUND IN THE IEEE  
I/O AREA)

200 SERIES POWER SUPPLY SECTION  
AND FUSE. (EX: U202 WILL BE FOUND IN  
THE POWER SUPPLY AREA)

LESS THAN 100'S ARE FOUND IN ALL OTHER  
AREAS OF THE A2 PCB ASSY.

8520A-1620(1 of 2)

See DETAIL B

See DETAIL A

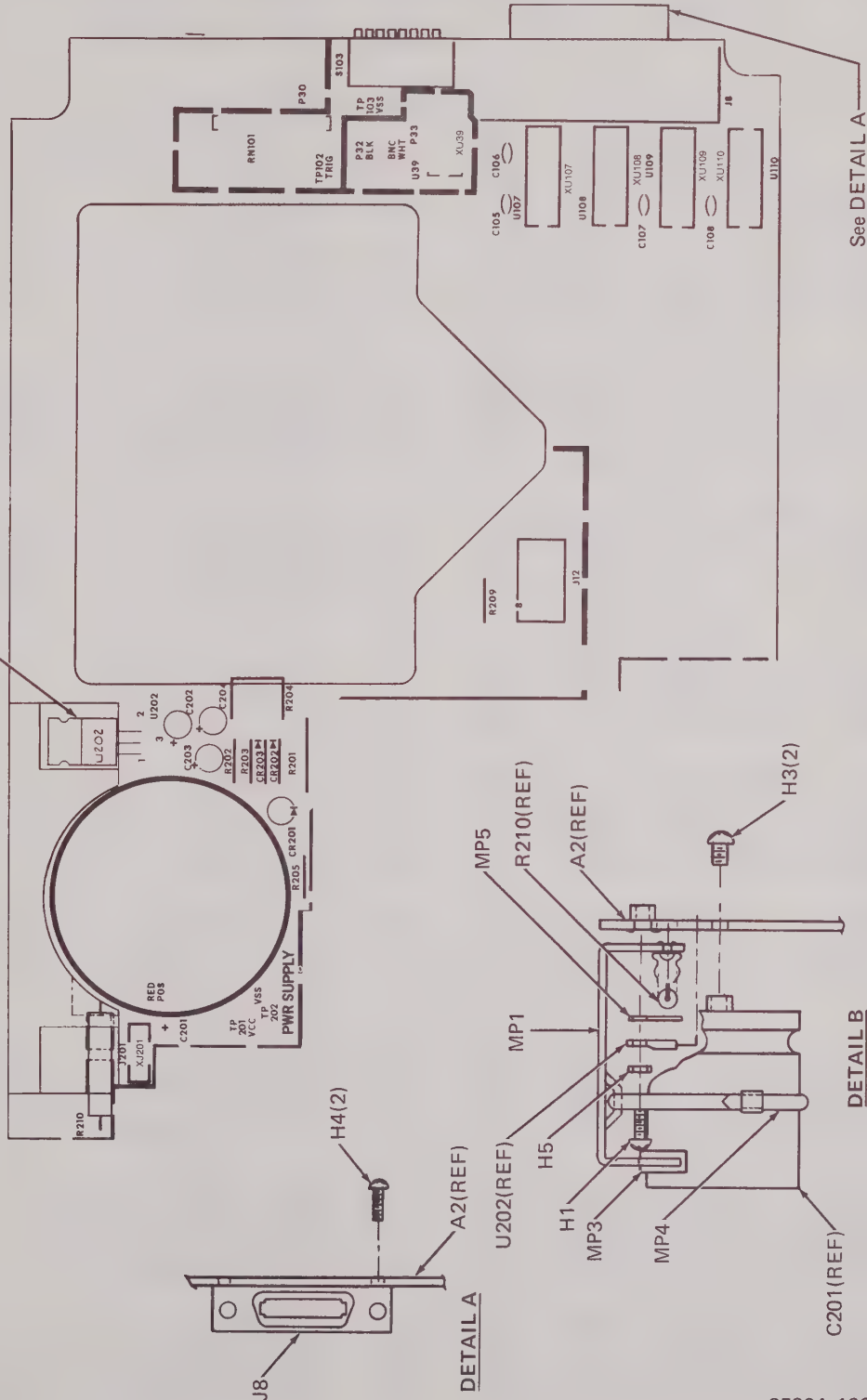


Figure 6-3. A2 Digital (Controller) PCB Assembly (cont)

Table 6-4. A3 Analog PCB Assembly

| REF<br>DES | DESCRIPTION                                     | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|-------------------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| A3         | ANALOG PCB ASSEMBLY<br>FIGURE 6-4 (8520A-4030T) | 496836                | 89536               | 496836                  | REF        |            |                  |
| A3A1       | REFERENCE MODULE (HORIZONTAL)                   | 527994                | 89536               | 527994                  | AR         |            | A                |
| A3A1       | REFERENCE MODULE (VERTICAL)                     | 530626                | 89536               | 530626                  | AR         |            | A                |
| BR701      | RECTIFIER BRIDGE                                | 296509                | 21845               | F903C-22                | 2          |            |                  |
| BR702      | RECTIFIER BRIDGE                                | 296509                | 21845               | F903C-22                | REF        |            |                  |
| C101       | CAP, MICA, 120 PF +/-5%, 500V                   | 148486                | 72136               | DM15F121J               | 1          |            |                  |
| C221       | CAP, POLYPRO, .0047 UF +/-10%, 200V             | 512830                | 89536               | 512830                  | 1          |            |                  |
| C222       | CAP, POLYPRO, .047 UF +/-10%, 50V               | 413328                | 89536               | 413328                  | 2          |            |                  |
| C223       | CAP, POLYPRO, .047 UF +/-10%, 50V               | 413328                | 89536               | 413328                  | REF        |            |                  |
| C224       | CAP, MYLAR, .047 UF +/-10%, 50V                 | 271858                | 06001               | 751R5A474               | 1          |            |                  |
| C225       | CAP, VAR, 0.25-1.5 PF, 2000V                    | 218206                | 72982               | 530-000                 | 4          |            |                  |
| C226       | CAP, TA, 68 UF +/-20%, 35V                      | 363713                | 56289               | 196D685X035KA1          | 8          |            |                  |
| C227       | CAP, MICA, 430 PF +/-5%, 500V                   | 177980                | 72136               | DM15F431J               | 4          |            |                  |
| C229       | CAP, MICA, 430 PF +/-5%, 500V                   | 177980                | 72136               | DM15F431J               | REF        |            |                  |
| C230       | CAP, POLYPRO, 1.0 UF +/-10%, 100V               | 501395                | 89536               | 501395                  | 1          |            |                  |
| C231       | CAP, VAR, 0.25-1.5 PF, 2000V                    | 218206                | 72982               | 530-000                 | REF        |            |                  |
| C233       | CAP, MICA, 430 PF +/-5%, 500V                   | 177980                | 72136               | DM15F431J               | REF        |            |                  |
| C235       | CAP, MICA, 430 PF +/-5%, 500V                   | 177980                | 72136               | DM15F431J               | REF        |            |                  |
| C236       | CAP, MICA, 47 PF +/-5%, 500V                    | 148536                | 72136               | DM15E470J               | 1          |            |                  |
| C237       | CAP, TA, 68 UF +/-20%, 35V                      | 363713                | 56289               | 196D685X035KA1          | REF        |            |                  |
| C238       | CAP, TA, 68 UF +/-20%, 35V                      | 363713                | 56289               | 196D685X035KA1          | REF        |            |                  |
| C239       | CAP, TA, 68 UF +/-20%, 35V                      | 363713                | 56289               | 196D685X035KA1          | REF        |            |                  |
| C240       | CAP, TA, 68 UF +/-20%, 35V                      | 363713                | 56289               | 196D685X035KA1          | REF        |            |                  |
| C241       | CAP, TA, 39 UF +/-20%, 6V                       | 163015                | 56289               | 196D396X0006KA1         | 2          |            |                  |
| C243       | CAP, CER, 0.0012 UF +/-10%, 500V                | 106732                | 71590               | CF122                   | 1          |            |                  |
| C244       | CAP, CER, 150 PF +/-5%, 100V                    | 512988                | 89536               | 512988                  | 1          |            |                  |
| C301       | CAP, MICA, 33 PF +/-5%, 500V                    | 160317                | 72136               | DM15F330J               | 5          |            |                  |
| C302       | CAP, MICA, 100 PF +/-5%, 500V                   | 148494                | 72136               | DM15F101J               | 5          |            |                  |
| C303       | CAP, MICA, 33 PF +/-5%, 500V                    | 160317                | 72136               | DM15F330J               | REF        |            |                  |
| C304       | CAP, MICA, 100 PF +/-5%, 500V                   | 148494                | 72136               | DM15F101J               | REF        |            |                  |
| C305       | CAP, TA, 68 UF +/-20%, 35V                      | 363713                | 56289               | 196D685X035KA1          | REF        |            |                  |
| C306       | CAP, TA, 68 UF +/-20%, 35V                      | 363713                | 56289               | 196D685X035KA1          | REF        |            |                  |
| C307       | CAP, TA, 68 UF +/-20%, 35V                      | 363713                | 56289               | 196D685X035KA1          | REF        |            |                  |
| C308       | CAP, TA, 39 UF +/-20%, 6V                       | 163015                | 56289               | 196D396X0006KA1         | REF        |            |                  |
| C310       | CAP, CER, 0.22 UF +/-20%, 50V                   | 309849                | 71590               | CW30C224K               | 4          |            |                  |
| C311       | CAP, CER, 0.22 UF +/-20%, 50V                   | 309849                | 71590               | CW30C224K               | REF        |            |                  |
| C312       | CAP, CER, 0.22 UF +/-20%, 50V                   | 309849                | 71590               | CW30C224K               | REF        |            |                  |
| C401       | CAP, FILM, .22 UF +/-10%, 1000V                 | 485797                | 52763               | MKT-1822322/10          | 1          |            |                  |
| C402       | CAP, PORC, 2.2 PF, 1700V                        | 340273                | 95275               | VY10CA2R2CA             | 1          |            |                  |
| C403       | CAP, VAR, 0.25-1.5 PF, 2000V                    | 218206                | 72982               | 530-000                 | REF        |            |                  |
| C404       | CAP, MICA, 15 PF +/-5%, 500V                    | 148569                | 72136               | DM15C150J               | 2          |            |                  |
| C408       | CAP, VAR, 0.25-1.5 PF, 2000V                    | 218206                | 72982               | 530-000                 | REF        |            |                  |
| C409       | CAP, CER, 6.8 PF +/-1PF, 1500W                  | 485383                | 56289               | 561CCOJBA102AE6R88      | 1          |            |                  |
| C412       | CAP, MICA, 390 PF +/-5%, 500V                   | 148437                | 72136               | DM15F391J               | 1          |            |                  |
| C414       | CAP, MICA, 62 PF +/-1%                          | 494617                | 72136               | DM15F620F               | 1          |            |                  |
| C415       | CAP, MICA, 560 PF +/-1%                         | 494609                | 72136               | DM15F561F               | 1          |            |                  |
| C417       | CAP, CER, 4700 PF +/-20%                        | 362871                | 32897               | 8121-A100-W5R-472M      | 1          |            |                  |
| C419       | CAP, MICA, 820 PF +/-10%, 500V                  | 226167                | 72136               | DM15F821F               | 1          |            |                  |

Table 6-4. A3 Analog PCB Assembly (cont)

| REF<br>DES | DESCRIPTION                      | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|----------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| C420       | CAP, MICA, 3600 PF +/-1%, 500V   | 529149                | 89536               | 529149                  | 1          |            |                  |
| C422       | CAP, CER, .047 UF +/-20%, 50V    | 460733                | 71590               | CW20C473M               | 1          |            |                  |
| C424       | CAP, TA, 1 UF +/-20%, 35V        | 161919                | 56289               | 196D105X00205A1         | 12         |            |                  |
| C425       | CAP, TA, 1 UF +/-20%, 35V        | 161919                | 56289               | 196D105X00205A1         | REF        |            |                  |
| C426       | CAP, TA, 1 UF +/-20%, 35V        | 161919                | 56289               | 196D105X00205A1         | REF        |            |                  |
| C427       | CAP, TA, 1 UF +/-20%, 35V        | 161919                | 56289               | 196D105X00205A1         | REF        |            |                  |
| C428       | CAP, MICA, 2PF +/-0.5%, 500V     | 175208                | 72136               | DN15C020D               | 1          |            |                  |
| C429       | CAP, CER, 0.05 -20/+80%, 25V     | 148924                | 72982               | 5855-000-Y5U0-503Z      | 2          |            |                  |
| C430       | CAP, CER, 0.05 -20/+80%, 25V     | 148924                | 72982               | 5855-000-Y5U0-503Z      | REF        |            |                  |
| C431       | CAP, TA, 1 UF +/-20%, 35V        | 161919                | 56289               | 196D105X00205A1         | REF        |            |                  |
| C432       | CAP, TA, 1 UF +/-20%, 35V        | 161919                | 56289               | 196D105X00205A1         | REF        |            |                  |
| C433       | CAP, MICA, 33 PF +/-5%, 500V     | 160317                | 72136               | DM15F330J               | REF        |            |                  |
| C435       | CAP, CER, 0.22 UF +/-20%, 50V    | 309849                | 71590               | CW30C224K               | REF        |            |                  |
| C436       | CAP, MYLAR, .068 UF +/-10%, 100V | 485441                | 89536               | 485441                  | 2          |            |                  |
| C437       | CAP, MYLAR, .012 UF +/-10%, 50V  | 402883                | 80031               | 75F1R5A123              | 1          |            |                  |
| C438       | CAP, TA, 1 UF +/-20%, 35V        | 161919                | 56289               | 196D105X00205A1         | REF        |            |                  |
| C440       | CAP, MYLAR, .015 UF +/-10%, 50V  | 402891                | 80031               | 75F1R5A153              | 1          |            |                  |
| C441       | CAP, MYLAR, .068 UF +/-10%, 100V | 485441                | 89536               | 485441                  | REF        |            |                  |
| C442       | CAP, POLY, .047 UF +/-10%, 100V  | 446773                | 89536               | 446773                  | 2          |            |                  |
| C443       | CAP, POLY, .047 UF +/-10%, 100V  | 446773                | 89536               | 446773                  | REF        |            |                  |
| C446       | CAP, CER, .005 UF +/-20%, 100V   | 175232                | 56289               | C023B101E502M           | 1          |            |                  |
| C447       | CAP, TA, 1 UF +/-20%, 35V        | 161919                | 56289               | 196D105X00205A1         | REF        |            |                  |
| C448       | CAP, TA, 1 UF +/-20%, 35V        | 161919                | 56289               | 196D105X00205A1         | REF        |            |                  |
| C450       | CAP, TA, 10 UF +/-20%, 20V       | 330662                | 56289               | 196D103X0020KA1         | 4          |            |                  |
| C451       | CAP, TA, 10 UF +/-20%, 20V       | 330662                | 56289               | 196D103X0020KA1         | REF        |            |                  |
| C452       | CAP, TA, 10 UF +/-20%, 20V       | 330662                | 56289               | 196D103X0020KA1         | REF        |            |                  |
| C453       | CAP, TA, 10 UF +/-20%, 20V       | 330662                | 56289               | 196D103X0020KA1         | REF        |            |                  |
| C455       | CAP, MICA, 100 PF +/-1%, 500V    | 226126                | 72136               | DM15F101F               | 1          |            |                  |
| C456       | CAP, TA, 22 UF +/-20%, 15V       | 423012                | 56289               | 196D226X0015KA1         | 6          |            |                  |
| C501       | CAP, MICA, 15 PF +/-5%, 500V     | 148569                | 72136               | DM15C150J               | REF        |            |                  |
| C502       | CAP, MICA, 33 PF +/-5%, 500V     | 160317                | 72136               | DM15F330J               | REF        |            |                  |
| C503       | CAP, MICA, 33 PF +/-5%, 500V     | 160317                | 72136               | DM15F330J               | REF        |            |                  |
| C504       | CAP, CER, 300 PF +/-10%, 1000V   | 105734                | 71590               | BB60301KW7W             | 2          |            |                  |
| C505       | CAP, .022 UF +/-10%, 100V        | 494948                | 89536               | 494948                  | 2          |            |                  |
| C506       | CAP, .022 UF +/-10%, 100V        | 494948                | 89536               | 494948                  | REF        |            |                  |
| C507       | CAP, TA, 4.7 UF +/-20%, 50V      | 363721                | 56289               | 196D475X0050PE4         | 4          |            |                  |
| C508       | CAP, TA, 4.7 UF +/-20%, 50V      | 363721                | 56289               | 196D475X0050PE4         | REF        |            |                  |
| C509       | CAP, MYLAR, .47 UF +/-10%, 100V  | 369124                | 73445               | C280H/A470K             | 1          |            |                  |
| C510       | CAP, CER, 300 PF +/-10%, 1000V   | 105734                | 71590               | BB60301KW7W             | REF        |            |                  |
| C511       | CAP, CER, 180 PF +/-10%, 500V    | 105890                | 89536               | 105890                  | 1          |            |                  |
| C601       | CAP, TA, 1 UF +/-20%, 35V        | 161919                | 56289               | 196D105X00205A1         | REF        |            |                  |
| C602       | CAP, MICA, 100 PF +/-5%, 500V    | 148494                | 72136               | DM15F101J               | REF        |            |                  |
| C603       | CAP, MICA, 100 PF +/-5%, 500V    | 148494                | 72136               | DM15F101J               | REF        |            |                  |
| C604       | CAP, TA, 10 UF +/-20%, 10V       | 176214                | 56289               | 196D106X0010KA1         | 4          |            |                  |
| C605       | CAP, TA, 10 UF +/-20%, 10V       | 176214                | 56289               | 196D106X0010KA1         | REF        |            |                  |
| C606       | CAP, TA, 10 UF +/-20%, 10V       | 176214                | 56289               | 196D106X0010KA1         | REF        |            |                  |
| C607       | CAP, TA, 10 UF +/-20%, 10V       | 176214                | 56289               | 196D106X0010KA1         | REF        |            |                  |
| C608       | CAP, TA, 10 UF +/-20%, 15V       | 193623                | 56289               | 196D106X0015A1          | 2          |            |                  |
| C609       | CAP, TA, 10 UF +/-20%, 15V       | 193623                | 56289               | 196D106X0015A1          | REF        |            |                  |
| C610       | CAP, TA, 1 UF +/-20%, 35V        | 161919                | 56289               | 196D105X00205A1         | REF        |            |                  |

Table 6-4. A3 Analog PCB Assembly (cont)

| REF<br>DES | DESCRIPTION                        | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| C612       | CAP, TA, 22 UF +/-20%, 15V         | 423012                | 56289               | 196D226X0015KA1         | REF        |            |                  |
| C614       | CAP, TA, 22 UF +/-20%, 15V         | 423012                | 56289               | 196D226X0015KA1         | REF        |            |                  |
| C615       | CAP, TA, 1 UF +/-20%, 35V          | 161919                | 56289               | 196D105X00205A1         | REF        |            |                  |
| C616       | CAP, TA, 22 UF +/-20%, 15V         | 423012                | 56289               | 196D226X0015KA1         | REF        |            |                  |
| C617       | CAP, MICA, 22 PF +/-5%, 500V       | 148551                | 72136               | DM15E220J               | 2          |            |                  |
| C618       | CAP, MICA, 22 PF +/-5%, 500V       | 148551                | 72136               | DM15E220J               | REF        |            |                  |
| C619       | CAP, MICA, 100 PF +/-5%, 500V      | 148494                | 72136               | DM15F101J               | REF        |            |                  |
| C706       | CAP, ELECT, 6800 UF -10/+100%, 15V | 478784                | 80031               | 3143AS752V015           | 1          |            |                  |
| C707       | CAP, TA, 2.2 UF +/-20%, 20V        | 161927                | 56289               | 196D2225X0020HA1        | 1          |            |                  |
| C708       | CAP, TA, 22 UF +/-20%, 15V         | 423012                | 56289               | 196D226X0015KA1         | REF        |            |                  |
| C709       | CAP, ELECT, 470 UF -10/+25%, 35V   | 478792                | 89536               | 478792                  | 2          |            |                  |
| C710       | CAP, ELECT, 470 UF -10/+25%, 35V   | 478792                | 89536               | 478792                  | REF        |            |                  |
| C711       | CAP, ELECT, 330 UF -10/+25%, 50V   | 484436                | 89536               | 484436                  | 2          |            |                  |
| C712       | CAP, ELECT, 330 UF -10/+25%, 50V   | 484436                | 89536               | 484436                  | REF        |            |                  |
| C717       | CAP, TANT, 22 UF +/-20%, 35V       | 394775                | 56289               | 196D226X0035TE4         | 2          |            |                  |
| C718       | CAP, TANT, 22 UF +/-20%, 35V       | 394775                | 56289               | 196D226X0035TE4         | REF        |            |                  |
| C719       | CAP, TA, 68 UF +/-20%, 35V         | 363713                | 56289               | 196D685X035KA1          | REF        |            |                  |
| C720       | CAP, TA, 68 UF +/-20%, 35V         | 363713                | 56289               | 196D685X035KA1          | REF        |            |                  |
| CR107      | DIODE, ZENER, +/-5%, 18V           | 327973                | 07910               | 1N967B                  | 4          |            | 1                |
| CR108      | DIODE, ZENER, +/-5%, 18V           | 327973                | 07910               | 1N967B                  | REF        |            |                  |
| CR109      | DIODE, ZENER, +/-5%, 18V           | 327973                | 07910               | 1N967B                  | REF        |            |                  |
| CR110      | DIODE, ZENER, +/-5%, 18V           | 327973                | 07910               | 1N967B                  | REF        |            |                  |
| CR215      | DIODE, SI, HI-SPEED SWITCHING      | 203323                | 07910               | 1N4448                  | 17         |            | 4                |
| CR216      | DIODE, CURRENT REGULATOR           | 284927                | 07910               | TCR5305                 | 2          |            | 1                |
| CR217      | DIODE, CURRENT REGULATOR           | 284927                | 07910               | TCR5305                 | REF        |            |                  |
| CR218      | DIODE, SI, RECTIFIER, 10V          | 180554                | 07910               | TD12599                 | 6          |            | 2                |
| CR219      | DIODE, SI, RECTIFIER, 10V          | 180554                | 07910               | TD12599                 | REF        |            |                  |
| CR301      | DIODE, ZENER, +/-10%, 10V          | 113324                | 07910               | 1N941A                  | 1          |            | 1                |
| CR304      | DIODE, ZENER, UNCOMPENSATED        | 256446                | 07910               | 1N755A                  | 1          |            | 1                |
| CR305      | DIODE, SI, HI-SPEED SWITCHING      | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR306      | DIODE, SI, HI-SPEED SWITCHING      | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR307      | DIODE, SI, HI-SPEED SWITCHING      | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR308      | DIODE, SI, HI-SPEED SWITCHING      | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR309      | DIODE, SI, HI-SPEED SWITCHING      | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR310      | DIODE, SI, HI-SPEED SWITCHING      | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR311      | DIODE, SI, HI-SPEED SWITCHING      | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR312      | DIODE, SI, HI-SPEED SWITCHING      | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR313      | DIODE, ZENER, +/-10%, 4.7V         | 387084                | 07910               | 1N750                   | 1          |            | 1                |
| CR402      | DIODE, LO-CAP, LO-LEAK             | 375907                | 07263               | FD7222                  | 1          |            | 1                |
| CR404      | DIODE, ZENER, 400 MW               | 260695                | 07910               | 1N754A                  | 1          |            | 1                |
| CR405      | DIODE, SI, SWITCHING               | 313247                | 28480               | HP5082-2811             | 3          |            | 1                |
| CR406      | DIODE, SI, SWITCHING               | 313247                | 28480               | HP5082-2811             | REF        |            |                  |
| CR407      | DIODE, SI, HI-SPEED SWITCHING      | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR408      | DIODE, SI, HI-SPEED SWITCHING      | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR409      | DIODE, SI, HI-SPEED SWITCHING      | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR410      | DIODE, SI, HI-SPEED SWITCHING      | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR411      | DIODE, ZENER, +/-5%, 8.2V          | 386771                | 07910               | 1N756A                  | 1          |            | 1                |
| CR501      | DIODE, SI, HI-SPEED SWITCHING      | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR502      | DIODE, SI, HI-SPEED SWITCHING      | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR503      | DIODE, SI, RECTIFIER, 10V          | 180554                | 07910               | TD12599                 | REF        |            |                  |

Table 6-4. A3 Analog PCB Assembly (cont)

| REF<br>DES | DESCRIPTION                   | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|-------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| CR504      | DIODE, SI, RECTIFIER, 10V     | 180554                | 07910               | TD12599                 | REF        |            |                  |
| CR505      | DIODE, SI, RECTIFIER, 10V     | 180554                | 07910               | TD12599                 | REF        |            |                  |
| CR506      | DIODE, SI, RECTIFIER, 10V     | 180554                | 07910               | TD12599                 | REF        |            |                  |
| CR507      | DIODE, SI, HI-SPEED SWITCHING | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR508      | DIODE, SI, SWITCHING          | 313247                | 28480               | HP5082-2811             | REF        |            |                  |
| CR601      | DIODE, SI, HI-SPEED SWITCHING | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| CR703      | DIODE, SI, RECTIFIER, 2A, 50V | 347559                | 14099               | 1N5400                  | 4          | 1          |                  |
| CR704      | DIODE, SI, RECTIFIER, 2A, 50V | 347559                | 14099               | 1N5400                  | REF        |            |                  |
| CR705      | DIODE, SI, RECTIFIER, 1A      | 343491                | 04791               | 1N4002                  | 2          | 1          |                  |
| CR706      | DIODE, SI, RECTIFIER, 1A      | 343491                | 04791               | 1N4002                  | REF        |            |                  |
| CR707      | DIODE, SI, RECTIFIER, 2A, 50V | 347559                | 14099               | 1N5400                  | REF        |            |                  |
| CR708      | DIODE, LED                    | 429555                | 12040               | NLS5053                 | 1          | 1          |                  |
| CR709      | DIODE, SI, RECTIFIER, 2A, 50V | 347559                | 14099               | 1N5400                  | REF        |            |                  |
| H1         | SCREW, PHP, 4-40 X 1/4        | 256156                | 89536               | 256156                  | 2          |            |                  |
| H2         | SCREW, PHP, 4-40 X 5/16       | 152116                | 89536               | 152116                  | 5          |            |                  |
| H3         | WASHER, SHOULDER              | 436386                | 89536               | 436836                  | 5          |            |                  |
| H4         | SPACER, STANDOFF (NOT SHOWN)  | 296319                | 89536               | 296319                  | 2          |            |                  |
| J418       | CONNECTING LINK               | 523159                | 89536               | 523159                  | 3          |            |                  |
| J419       | CONNECTING LINK               | 523159                | 89536               | 523159                  | REF        |            |                  |
| J420       | CONNECTING LINK               | 523159                | 89536               | 523159                  | REF        |            |                  |
| K101       | RELAY, 4-POLE                 | 519710                | 89536               | 519710                  | 1          |            |                  |
| K103       | RELAY, 4-POLE                 | 422931                | 26806               | AZ-421-14-200           | 1          |            |                  |
| K104       | RELAY, DRY REED               | 500132                | 89536               | 500132                  | 3          |            |                  |
| K301       | RELAY, DRY REED               | 357582                | 71707               | UF-40070                | 3          |            |                  |
| K302       | RELAY, DRY REED               | 357582                | 71707               | UF-40070                | REF        |            |                  |
| K303       | RELAY, DRY REED               | 357582                | 71707               | UF-40070                | REF        |            |                  |
| K304       | RELAY, DRY REED               | 500132                | 89536               | 500132                  | REF        |            |                  |
| K401       | RELAY, DRY REED               | 500132                | 89536               | 500132                  | REF        |            |                  |
| L601       | CHOKE, 6-TURN                 | 320911                | 89536               | 320911                  | 1          |            |                  |
| MP1        | BALL STUD                     | 347542                | 89536               | 347542                  | 6          |            |                  |
| MP2        | BRACKET, ANA HEATSINK         | 490995                | 89536               | 490995                  | 1          |            |                  |
| MP3        | CABLE, JUMPER (NOT SHOWN)     | 474148                | 00779               | 86942-5                 | 1          |            |                  |
| MP4        | CONNECTOR AMP POST            | 512889                | 00779               | 62395-1                 | 42         |            |                  |
| MP5        | CONNECTOR, PCB                | 233411                | 00779               | 60599-3                 | 2          |            |                  |
| MP8        | INSULATOR, XSTR               | 508630                | 89536               | 508630                  | 5          |            |                  |
| MP9        | HEATSINK                      | 347740                | 05820               | 260-18D                 | 1          |            |                  |
| MP10       | RELAY SOCKET, 2-PIN           | 376665                | 77342               | 27E501                  | 1          |            |                  |
| MP11       | RELAY SOCKET, 4-PIN           | 441964                | 77342               | 27E606                  | 2          |            |                  |
| MP12       | FEED THRU TERMINAL            | 281865                | 89536               | 281865                  | 2          |            |                  |
| MP13       | SOCKET, IC, 8-PIN             | 478016                | 91506               | 308-AG39D               | 10         |            |                  |
| MP14       | SOCKET, IC, 20-PIN            | 454421                | 01295               | C932002                 | 4          |            |                  |
| MP15       | SOCKET, IC, 24-PIN            | 418970                | 91506               | 3240AG39D               | 1          |            |                  |
| MP16       | SOCKET, IC, 40-PIN            | 418988                | 91506               | 340-AG39D               | 2          |            |                  |
| MP17       | SOCKET, IC, 14-PIN            | 370304                | 01295               | C931402                 | 17         |            |                  |
| MP18       | SOCKET, IC, 4-PIN             | 417311                | 30035               | SS-109-1-04             | 4          |            |                  |
| MP19       | SOCKET, IC, 8-PIN             | 408450                | 89536               | 408450                  | 11         |            |                  |
| MP20       | SOCKET, IC, 16-PIN            | 276535                | 91506               | 316-AG39D               | 13         |            |                  |
| MP21       | SOCKET, IC, 18-PIN            | 418228                | 91506               | 318-AG39D               | 3          |            |                  |
| MP22       | SOCKET, XSTR (NOT SHOWN)      | 285262                | 71785               | 1-33-23-92-045          | 79         |            |                  |
| MP23       | SOCKET, XSTR                  | 402958                | 27264               | 10-18-2031              | 5          |            |                  |

Table 6-4. A3 Analog PCB Assembly (cont)

| REF<br>DES | DESCRIPTION                                                              | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|--------------------------------------------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| MP24       | WIRE RETAINER                                                            | 376459                | 77342               | 20C249                  | 1          |            |                  |
| MP25       | WIRE RETAINER                                                            | 500108                | 77342               | 20C250                  | 2          |            |                  |
| MP26       | HEADER, PROGRAMMED, 4-PIN                                                | 504373                | 51167               | 14-675-191              | 4          |            |                  |
| MP27       | HEADER, PROGRAMMED, 16-PIN                                               | 495507                | 89536               | 495507                  | 1          |            |                  |
| MP28       | SHIELD, AC CONVERTER                                                     | 514984                | 89536               | 514984                  | 1          |            |                  |
| MP29       | SHIELD, DC BUFFER                                                        | 496786                | 89536               | 496786                  | 1          |            |                  |
| P17        | CONNECTOR, 11-PIN                                                        | 494666                | 00779               | 1-640456-1              | 1          |            |                  |
| Q103       | XSTR, N-CHAN, J-FET                                                      | 483099                | 12040               | PF5301                  | 5          | 1          |                  |
| Q104       | XSTR, N-CHAN, J-FET, HI-VOLT                                             | 524157                | 21845               | 2N5459                  | 3          | 1          |                  |
| Q106       | XSTR, N-CHAN, J-FET                                                      | 483099                | 12040               | PF5301                  | REF        |            |                  |
| Q107       | XSTR, N-CHAN, J-FET                                                      | 483099                | 12040               | PF5301                  | REF        |            |                  |
| Q108       | XSTR, N-CHAN, J-FET                                                      | 483099                | 12040               | PF5301                  | REF        |            |                  |
| Q111       | XSTR, FET N-CHANNEL, HI-VOLTAGE                                          | 393314                | 17856               | ITS30721                | 7          | 2          |                  |
| Q112       | XSTR, FET N-CHANNEL, HI-VOLTAGE                                          | 393314                | 17856               | ITS30721                | REF        |            |                  |
| Q113       | XSTR, FET N-CHANNEL, HI-VOLTAGE                                          | 393314                | 17856               | ITS30721                | REF        |            |                  |
| Q114       | XSTR, FET N-CHANNEL, HI-VOLTAGE                                          | 393314                | 17856               | ITS30721                | REF        |            |                  |
| Q221       | XSTR, N-CHAN, J-FET, HI-VOLT                                             | 524157                | 21845               | 2N5459                  | REF        |            |                  |
| Q223       | XSTR, N-CHAN, J-FET, HI-VOLT                                             | 524157                | 21845               | 2N5459                  | REF        |            |                  |
| Q224       | XSTR, N-CHAN, J-FET                                                      | 483099                | 12040               | PF5301                  | REF        |            |                  |
| Q225       | XSTR, NPN, HI-SPEED SWITCHING                                            | 369629                | 07263               | S43576                  | 2          | 1          |                  |
| Q226       | XSTR, NPN, HI-SPEED SWITCHING                                            | 369629                | 07263               | S43576                  | REF        |            |                  |
| Q227       | XSTR, DUAL, N-CHAN, J-FET, MONO                                          | 478172                | 32293               | IT502P                  | 2          | 1          |                  |
| Q228       | XSTR, SI, NPN                                                            | 218396                | 04713               | 2N3904                  | 5          | 1          |                  |
| Q229       | XSTR, SI, NPN                                                            | 218396                | 04713               | 2N3904                  | REF        |            |                  |
| Q230       | XSTR, SI, NPN                                                            | 218396                | 04713               | 2N3904                  | REF        |            |                  |
| Q231       | XSTR, FET, D-MOS, N-CHAN                                                 | 394122                | 18324               | SD210                   | 3          | 1          |                  |
| Q232       | XSTR, FET, D-MOS, N-CHAN                                                 | 394122                | 18324               | SD210                   | REF        |            |                  |
| Q233       | XSTR, FET, D-MOS, N-CHAN                                                 | 394122                | 18324               | SD210                   | REF        |            |                  |
| Q234       | XSTR, DUAL, N-CHAN, J-FET, MONO                                          | 478172                | 32293               | IT502P                  | REF        |            |                  |
| Q235       | XSTR, SI, NPN                                                            | 218396                | 04713               | 2N3904                  | REF        |            |                  |
| Q236       | XSTR, FET N-CHANNEL, HI-VOLTAGE                                          | 393314                | 17856               | ITS30721                | REF        |            |                  |
| Q237       | XSTR, FET N-CHANNEL, HI-VOLTAGE                                          | 393314                | 17856               | ITS30721                | REF        |            |                  |
| Q238       | XSTR, FET N-CHANNEL, HI-VOLTAGE                                          | 393314                | 17856               | ITS30721                | REF        |            |                  |
| Q239       | XSTR, SI, PNP                                                            | 266619                | 07263               | 2N4888                  | 2          | 1          |                  |
| Q240       | XSTR, SI, PNP                                                            | 266619                | 07263               | 2N4888                  | REF        |            |                  |
| Q304       | XSTR, SI, NPN                                                            | 218396                | 04713               | 2N3904                  | REF        |            |                  |
| Q305       | XSTR, J-FET, N-CHAN                                                      | 508697                | 17856               | J2306                   | 7          | 2          |                  |
| Q306       | XSTR, J-FET, N-CHAN                                                      | 508697                | 17856               | J2306                   | REF        |            |                  |
| Q308       | XSTR, FET, N-CHANNEL                                                     | 343830                | 89536               | 343830                  | 1          | 1          |                  |
| Q309       | XSTR, DUAL, NPN                                                          | 478099                | 12040               | LM394CH                 | 1          | 1          |                  |
| Q310       | XSTR, SI, NPN                                                            | 168716                | 07263               | S19254                  | 2          | 1          |                  |
| Q311       | XSTR, SI, NPN                                                            | 168716                | 07263               | S19254                  | REF        |            |                  |
| Q314       | XSTR, SI, NPN                                                            | 302489                | 09214               | 11C-2322                | 2          | 1          |                  |
| Q315       | XSTR, SI, NPN                                                            | 302489                | 09214               | 11C-2322                | REF        |            |                  |
| Q316       | XSTR MATCHED SET (PAIRED)<br>(Q316, Q510, Q511, AND<br>Q501, Q502, Q503) | 274795                | 89536               | 274795                  | 2          | 1          |                  |
| Q317       | XSTR, SMALL SIGNAL                                                       | 524140                | 04713               | MPS-A63                 | 1          | 1          |                  |
| Q401       | XSTR, J-FET, N-CHANNEL                                                   | 288324                | 89536               | 288324                  | 5          |            |                  |
| Q402       | XSTR, FET, N-CHANNEL                                                     | 261578                | 89536               | 261578                  | 18         | 4          |                  |

Table 6-4. A3 Analog PCB Assembly (cont)

| REF<br>DES | DESCRIPTION                                                                               | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|-------------------------------------------------------------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| Q403       | XSTR, J-FET, N-CHANNEL                                                                    | 288324                | 89536               | 288324                  | REF        |            |                  |
| Q404       | XSTR, J-FET, N-CHANNEL                                                                    | 288324                | 89536               | 288324                  | REF        |            |                  |
| Q405       | XSTR, J-FET, N-CHANNEL                                                                    | 288324                | 89536               | 288324                  | REF        |            |                  |
| Q406       | XSTR, J-FET, N-CHANNEL                                                                    | 288324                | 89536               | 288324                  | REF        |            |                  |
| Q407       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q408       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q409       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q410       | XSTR, SI, PNP                                                                             | 229898                | 04713               | MPS6522                 | 1          | 1          |                  |
| Q411       | XSTR, SI, NPN                                                                             | 218081                | 04713               | MPS6520                 | 1          | 1          |                  |
| Q414       | XSTR MATCHED SET<br>(Q414, Q415)                                                          | 504191                | 89536               | 504191                  | 1          | 1          |                  |
| Q415       | PART OF Q414 SET                                                                          |                       |                     |                         |            |            |                  |
| Q416       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q417       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q418       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q419       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q421       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q501       | PART OF PAIRED SET, Q316                                                                  |                       |                     |                         |            |            |                  |
| Q502       | PART OF PAIRED SET, Q316                                                                  |                       |                     |                         |            |            |                  |
| Q503       | PART OF PAIRED SET, Q316                                                                  |                       |                     |                         |            |            |                  |
| Q504       | XSTR, FET, SET (Q504, Q505)                                                               | 261578                | 89536               | 261578                  | 1          | 1          |                  |
| Q505       | PART OF Q504 SET                                                                          |                       |                     |                         |            |            |                  |
| Q506       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q507       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q508       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q509       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q510       | PART OF PAIRED SET, Q316                                                                  |                       |                     |                         |            |            |                  |
| Q511       | PART OF PAIRED SET, Q316                                                                  |                       |                     |                         |            |            |                  |
| Q512       | XSTR SET, FET, GROUPED<br>(Q512, Q513, Q515, Q517, Q519, Q521,<br>Q523, Q524, Q525, Q526) | 492306                | 89536               | 492306                  | 1          | 1          |                  |
| Q513       | PART OF Q512 SET                                                                          |                       |                     |                         |            |            |                  |
| Q514       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q515       | PART OF Q512 SET                                                                          |                       |                     |                         |            |            |                  |
| Q516       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q517       | PART OF Q512 SET                                                                          |                       |                     |                         |            |            |                  |
| Q518       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q519       | PART OF Q512 SET                                                                          |                       |                     |                         |            |            |                  |
| Q520       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q521       | PART OF Q512 SET                                                                          |                       |                     |                         |            |            |                  |
| Q522       | XSTR, FET, N-CHANNEL                                                                      | 261578                | 89536               | 261578                  | REF        |            |                  |
| Q523       | PART OF Q512 SET                                                                          |                       |                     |                         |            |            |                  |
| Q524       | PART OF Q512 SET                                                                          |                       |                     |                         |            |            |                  |
| Q525       | PART OF Q512 SET                                                                          |                       |                     |                         |            |            |                  |
| Q526       | PART OF Q512 SET                                                                          |                       |                     |                         |            |            |                  |
| Q527       | XSTR, SI, PNP                                                                             | 195974                | 04713               | 2N3906                  | 1          | 1          |                  |
| Q528       | XSTR, J-FET, N-CHAN                                                                       | 508697                | 17856               | J2306                   | REF        |            |                  |
| Q529       | XSTR, J-FET, N-CHAN                                                                       | 508697                | 17856               | J2306                   | REF        |            |                  |
| Q530       | XSTR, J-FET, N-CHAN                                                                       | 508697                | 17856               | J2306                   | REF        |            |                  |
| Q531       | XSTR, J-FET, N-CHAN                                                                       | 508697                | 17856               | J2306                   | REF        |            |                  |

Table 6-4. A3 Analog PCB Assembly (cont)

| REF<br>DES | DESCRIPTION                             | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|-----------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| Q532       | XSTR, J-FET, N-CHAN                     | 508697                | 17856               | J2306                   | REF        |            |                  |
| R101       | THERMISTOR, 500 +/-20%, 1000V           | 500017                | 89536               | 500017                  | 2          | 1          |                  |
| R102       | THERMISTOR, 500 +/-20%, 1000V           | 500017                | 89536               | 500017                  | REF        |            |                  |
| R103       | RES, CURRENT LIMITING, 1K +/-40%, 1000V | 494740                | 89536               | 494740                  | 1          |            |                  |
| R104       | RES, MTL FILM, 2K +/-1%, 7W             | 500033                | 89536               | 500033                  | 1          |            |                  |
| R109       | RES, VAR, 200 +/-10%, 1/2W              | 275743                | 11236               | 360T201A                | 1          | 1          |                  |
| R110       | RES, COMP, 150K +/-5%, 2W               | 110122                | 01121               | HB1545                  | 1          |            |                  |
| R111       | RES, DEP. CAR, 220K +/-5%, 1/4W         | 348953                | 80031               | CR251-4-5P220K          | 1          |            |                  |
| R112       | RES, DEP. CAR, 150K +/-5%, 1/4W         | 348938                | 80031               | CR251-4-5P150K          | 1          |            |                  |
| R113       | RES, COMP, 1M +/-10%, 1/2W              | 108134                | 01121               | EB1051                  | 1          |            |                  |
| R114       | RES, MTL. FILM, 150K +/-1%, 1/8W        | 241083                | 91637               | CMF551503F              | 2          |            |                  |
| R115       | RES, MTL. FILM, 150K +/-1%, 1/8W        | 241083                | 91637               | CMF551503F              | REF        |            |                  |
| R120       | RES, DEP. CAR, 8.2K +/-5%, 1/4W         | 441675                | 80031               | CR251-4-5P8K2           | 2          |            |                  |
| R121       | RES, DEP. CAR, 8.2K +/-5%, 1/4W         | 441675                | 80031               | CR251-4-5P8K2           | REF        |            |                  |
| R223       | RES, MTL. FILM, 71.5K +/-1%, 1/8W       | 291435                | 91637               | CMF557152F              | 3          |            |                  |
| R224       | RES, MTL. FILM, 169K +/-1%, 1/8W        | 289454                | 91637               | CMF551693F              | 1          |            |                  |
| R225       | RES, MTL. FILM, 1K +/-1%, 1/8W          | 168229                | 91637               | CMF551001F              | 5          |            |                  |
| R226       | RES, MTL. FILM, 1K +/-1%, 1/8W          | 168229                | 91637               | CMF551001F              | REF        |            |                  |
| R227       | RES, MTL. FILM, 20K +/-1%, 1/8W         | 291872                | 91637               | CMF552002F              | 8          |            |                  |
| R228       | RES, MTL. FILM, 20K +/-1%, 1/8W         | 291872                | 91637               | CMF552002F              | REF        |            |                  |
| R229       | RES, MTL. FILM, 93.1K +/-1%, 1/8W       | 223586                | 91637               | CMF559312F              | 1          |            |                  |
| R230       | RES, MTL. FILM, 14.7K +/-1%, 1/8W       | 226225                | 91637               | CMF551472F              | 1          |            |                  |
| R231       | RES, MTL. FILM, 20K +/-1%, 1/8W         | 291872                | 91637               | CMF552002F              | REF        |            |                  |
| R232       | RES, MTL. FILM, 1.21K +/-1%, 1/8W       | 229146                | 91637               | CMF551211F              | 2          |            |                  |
| R234       | RES, MTL. FILM, 1.87K +/-1%, 1/8W       | 267229                | 91637               | CMF551871F              | 1          |            |                  |
| R235       | RES, MTL. FILM, 1.47K +/-1%, 1/8W       | 293654                | 91637               | CMF551471F              | 1          |            |                  |
| R236       | RES, VAR, 5K +/-10%, 1/2W               | 327569                | 11236               | 360T502A                | 1          | 1          |                  |
| R237       | RES, MTL. FILM, 1.21K +/-1%, 1/8W       | 229146                | 91637               | CMF551211F              | REF        |            |                  |
| R239       | RES, MTL. FILM, 1.3K +/-1%, 1/8W        | 343921                | 91637               | CMF551301F              | 2          |            |                  |
| R240       | RES, MTL. FILM, 1K +/-1%, 1/8W          | 168229                | 91637               | CMF551001F              | REF        |            |                  |
| R241       | RES, MTL. FILM, 1K +/-1%, 1/8W          | 168229                | 91637               | CMF551001F              | REF        |            |                  |
| R242       | RES, DEP. CAR, 390 +/-5%, 1/2W          | 441543                | 80031               | CR251-4-5P390E          | 3          |            |                  |
| R243       | RES, MTL. FILM, 20K +/-1%, 1/8W         | 291872                | 91637               | CMF552002F              | REF        |            |                  |
| R244       | RES, MTL. FILM, 20K +/-1%, 1/8W         | 291872                | 91637               | CMF552002F              | REF        |            |                  |
| R247       | RES, MTL. FILM, 20K +/-1%, 1/8W         | 291872                | 91637               | CMF552002F              | REF        |            |                  |
| R251       | RES, VAR, 100 +/-10%, 1/2W              | 275735                | 11236               | 360T101A                | 6          | 2          |                  |
| R252       | RES, MTL. FILM, 71.5K +/-1%, 1/8W       | 291435                | 91637               | CMF557152F              | REF        |            |                  |
| R253       | RES, VAR, 100 +/-10%, 1/2W              | 275735                | 11236               | 360T101A                | REF        |            |                  |
| R254       | RES, MTL. FILM, 71.5K +/-1%, 1/8W       | 291435                | 91637               | CMF557152F              | REF        |            |                  |
| R255       | RES, CAR. DEP, 15 +/-5%, 1/4W           | 348755                | 80031               | CR251-4-5P15E           | 2          |            |                  |
| R256       | RES, CAR. DEP, 15 +/-5%, 1/4W           | 348755                | 80031               | CR251-4-5P15E           | REF        |            |                  |
| R257       | RES, DEP. CAR, 150 +/-5%, 1/4W          | 343442                | 80031               | CR251-4-5P150E          | 5          |            |                  |
| R258       | RES, DEP. CAR, 150 +/-5%, 1/4W          | 343442                | 80031               | CR251-4-5P150E          | REF        |            |                  |
| R261       | RES, DEP. CAR, 10K +/-5%, 1/4W          | 348839                | 80031               | CR251-4-5P10K           | 8          |            |                  |
| R264       | RES, DEP. CAR, 10K +/-5%, 1/4W          | 348839                | 80031               | CR251-4-5P10K           | REF        |            |                  |
| R265       | RES, DEP. CAR, 47K +/-5%, 1/4W          | 348821                | 80031               | CR251-4-5P47K           | 2          |            |                  |
| R266       | RES, DEP. CAR, 47K +/-5%, 1/4W          | 348821                | 80031               | CR251-4-5P47K           | REF        |            |                  |
| R267       | RES, MTL. FILM, 2.74K +/-1%, 1/8W       | 293761                | 91637               | CMF552741F              | 2          |            |                  |
| R268       | RES, MTL. FILM, 12.7K +/-1%, 1/8W       | 294918                | 91637               | CMF551272F              | 1          |            |                  |
| R269       | RES, MTL. FILM, 2.74K +/-1%, 1/8W       | 293761                | 91637               | CMF552741F              | REF        |            |                  |

Table 6-4. A3 Analog PCB Assembly (cont)

| REF<br>DES | DESCRIPTION                            | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|----------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| R270       | RES, MTL. FILM, 6.49K +/-1%, 1/8W      | 289553                | 91637               | CMF556491F              | 2          |            |                  |
| R271       | RES, MTL. FILM, 12.7K +/-1%, 1/8W      | 217448                | 91637               | CMF551272               | 1          |            |                  |
| R272       | THERMISTOR                             | 104596                | 89536               | 104596                  | 1          | 1          |                  |
| R273       | RES, COMP, 100M, +/-10%, 1/2W          | 190520                | 01121               | EB1071                  | 2          |            |                  |
| R274       | RES, COMP, 100M, +/-10%, 1/2W          | 190520                | 01121               | EB1071                  | REF        |            |                  |
| R303       | REFERENCE RESISTOR, 24.982K            | 503821                | 89536               | 503821                  | 1          |            |                  |
| R305       | RES, DEP. CAR, 1K +/-5%, 1/4W          | 343426                | 80031               | CR251-4-5P1K            | 5          |            |                  |
| R306       | RES, MTL. FILM, 76.8K +/-1%, 1/8W      | 257394                | 91637               | CMF557682F              | 1          |            |                  |
| R307       | RES, MTL. FILM, 57.6K +/-1%, 1/8W      | 484915                | 91637               | CMF555762F              | 1          |            |                  |
| R308       | RES, MTL. FILM, 25.5K +/-1%, 1/8W      | 446666                | 91637               | CMF552552F              | 1          |            |                  |
| R309       | RES, DEP. CAR, 100 +/-5%, 1/4W         | 348771                | 80031               | CR251-4-5P100E          | 2          |            |                  |
| R311       | RES, VAR, 500 +/-10%, 1/2W             | 325613                | 11236               | 360T501A                | 3          | 1          |                  |
| R312       | RES, DEP. CAR, 10K +/-5%, 1/4W         | 348839                | 80031               | CR251-4-5P10K           | REF        |            |                  |
| R314       | RES, VAR, 50 +/-10%, 1/2W              | 447862                | 11236               | 360T500A                | 4          | 1          |                  |
| R315       | RES, VAR, 1K +/-10%, 1/2W              | 275750                | 11236               | 360T102A                | 2          | 1          |                  |
| R317       | RES, VAR, 50K +/-10%, 1/2W             | 335778                | 11236               | 360T503A                | 1          | 1          |                  |
| R318       | RES, MTL. FILM, 191K +/-1%, 1/8W       | 375923                | 91637               | CMF551913F              | 1          |            |                  |
| R319       | RES, VAR, 10 +/-10%, 0.5,3/4W          | 485458                | 89536               | 485458                  | 3          | 1          |                  |
| R320       | RES, FILM, 4.0455M +/-0.1%, 300V       | 474932                | 89536               | 474932                  | 1          | 1          |                  |
| R321       | RES, FILM, 449.55K +/-0.1%, 1/3W, 300V | 478990                | 89536               | 478990                  | 1          |            |                  |
| R322       | RES, MTL. FILM, 13.7K +/-1%, 1/8W      | 236752                | 91637               | CMF551372F              | 1          |            |                  |
| R323       | RES, MTL. FILM, 20K +/-1%, 1/8W        | 235226                | 91637               | CMF552002F              | 1          |            |                  |
| R324       | RES, MTL. FILM, 20K +/-1%, 1/8W        | 291872                | 91637               | CMF552002F              | REF        |            |                  |
| R325       | RES, VAR, 25K +/-10%, 1/2W             | 500769                | 32997               | 3299W-1-253             | 1          | 1          |                  |
| R326       | RES, MTL. FILM, 20K +/-1%, 1/8W        | 291872                | 91637               | CMF552002F              | REF        |            |                  |
| R327       | RES, MATCHED SET (R327, R328)          | 290320                | 89536               | 290320                  | 1          |            |                  |
| R328       | PART OF R327                           |                       |                     |                         |            |            |                  |
| R329       | RES, MTL. FILM, 12.1K +/-1%, 1/8W      | 324997                | 91637               | CMF551212F              | 1          |            |                  |
| R330       | RES, MTL. FILM, 3.16M +/-1%, 1/8W      | 494815                | 91637               | CMF553164F              | 1          |            |                  |
| R331       | RES, DEP. CAR, 10K +/-5%, 1/4W         | 348839                | 80031               | CR251-4-5P10K           | REF        |            |                  |
| R332       | RES, MTL. FILM, 10K +/-5%, 6W          | 500025                | 89536               | 500025                  | 1          |            |                  |
| R334       | RES, DEP. CAR, 150 +/-5%, 1/4W         | 343442                | 80031               | CR251-4-5P150E          | REF        |            |                  |
| R335       | RES, DEP. CAR, 150 +/-5%, 1/4W         | 343442                | 80031               | CR251-4-5P150E          | REF        |            |                  |
| R336       | RES, DEP. CAR, 150 +/-5%, 1/4W         | 343442                | 80031               | CR251-4-5P150E          | REF        |            |                  |
| R341       | RES, MTL. FILM, 37.4K +/-1%, 1/8W      | 226241                | 91637               | CMF553742F              | 1          |            |                  |
| R342       | RES, DEP. CAR, 100 +/-5%, 1/4W         | 348771                | 80031               | CR251-4-5P00E           | REF        |            |                  |
| R343       | RES, DEP. CAR, 330K +/-5%, 1/4W        | 376640                | 80031               | CR251-4-5P330K          | 1          |            |                  |
| R401       | RES, COMP, 560 +/-5%, 1/4W             | 147991                | 01121               | CB5615                  | 1          |            |                  |
| R403       | RES, FILM, 1.1104M +/-0.05%, 3/4W      | 493627                | 89536               | 493627                  | 1          |            |                  |
| R408       | RES, VAR, 10 +/-10%, 0.5,3/4W          | 485458                | 89536               | 485458                  | REF        |            |                  |
| R412       | RES, MTL. FILM, 556.39K +/-0.1%, 1/8W  | 485367                | 89536               | 485367                  | 1          |            |                  |
| R421       | RES, MTL. FILM, 79.240K +/-0.1%, 1/8W  | 495334                | 89536               | 495334                  | 1          |            |                  |
| R422       | RES, VAR, 500 +/-10%, 1/2W             | 325613                | 11236               | 360T501A                | REF        |            |                  |
| R425       | RES, VAR, 100 +/-10%, 1/2W             | 275735                | 11236               | 360T101A                | REF        |            |                  |
| R426       | RES, VAR, 100 +/-10%, 1/2W             | 275735                | 11236               | 360T101A                | REF        |            |                  |
| R427       | RES, DEP. CAR, 2K +/-5%, 1/4W          | 441469                | 80031               | CR251-4-5P2K            | 4          |            |                  |
| R428       | RES, DEP. CAR, 2K +/-5%, 1/4W          | 441469                | 80031               | CR251-4-5P2K            | REF        |            |                  |
| R432       | RES, MTL. FILM, 8.8091K +/-0.1%, 1/8W  | 485342                | 89536               | 485342                  | 1          |            |                  |
| R433       | RES, VAR, 50 +/-10%, 1/2W              | 447862                | 11236               | 360T500A                | REF        |            |                  |
| R435       | RES, DEP. CAR, 62K +/-5%, 1/4W         | 348904                | 80031               | CR251-4-5P62K           | 1          |            |                  |

Table 6-4. A3 Analog PCB Assembly (cont)

| REF<br>DES | DESCRIPTION                        | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| R436       | RES, MTL. FILM, 1.1108K +/-1% 1/8W | 485359                | 89536               | 485359                  | 1          |            |                  |
| R437       | RES, MTL. FILM, 47.5K +/-1%, 1/8W  | 289546                | 91637               | CMF554752F              | 1          |            |                  |
| R438       | RES, VAR, 20K +/-10%, 1/2W         | 335760                | 11236               | 360T023A                | 1          | 1          |                  |
| R439       | RES, DEP. CAR, 51K +/-5%, 1/4W     | 376434                | 80031               | CR251-4-5P51K           | 1          |            |                  |
| R440       | RES, VAR, 50 +/-10%, 1/2W          | 500009                | 89536               | 500009                  | 1          | 1          |                  |
| R441       | RES, MTL. FILM, 4.975K +/-1% 1/8W  | 340232                | 89536               | 340232                  | 1          |            |                  |
| R442       | RES, MTL. FILM, 169 +/-1%, 1/8W    | 236869                | 91637               | CMF551690F              | 1          |            |                  |
| R443       | RES, MTL. FILM, 1M +/-1%, 1/8W     | 268797                | 91637               | MFF1-81004F             | 3          |            |                  |
| R444       | RES, DEP. CAR, 1.5K +/-5%, 1/4W    | 343418                | 80031               | CR251-4-5P1K5           | 2          |            |                  |
| R445       | RES, VAR, 200K +/-10%, 1/2W        | 381921                | 32997               | 3299W-1-204             | 2          | 1          |                  |
| R446       | RES, DEP. CAR, 2.4K +/-5%, 1/4W    | 441493                | 80031               | CR251-4-5P2K4           | 2          |            |                  |
| R447       | RES, DEP. CAR, 2.4K +/-5%, 1/4W    | 441493                | 80031               | CR251-4-5P2K4           | REF        |            |                  |
| R448       | RES, DEP. CAR, 510 +/-5%, 1/4W     | 441600                | 80031               | CR251-4-5P510E          | 4          |            |                  |
| R449       | RES, DEP. CAR, 3K +/-5%, 1/4W      | 441527                | 80031               | CR251-4-5P3K            | 2          |            |                  |
| R450       | RES, DEP. CAR, 9.1K +/-5%, 1/4W    | 441691                | 80032               | CR251-4-5P9K1           | 1          |            |                  |
| R451       | RES, DEP. CAR, 3K +/-5%, 1/4W      | 441527                | 80031               | CR251-4-5P3K            | REF        |            |                  |
| R452       | RES, DEP. CAR, 510 +/-5%, 1/4W     | 441600                | 80031               | CR251-4-5P510E          | REF        |            |                  |
| R453       | RES, MTL. FILM, 4.99K +/-1%, 1/8W  | 168252                | 91637               | CMF554991F              | 1          |            |                  |
| R454       | RES, CAR. DEP, 750 +/-5%, 1/4W     | 441659                | 80031               | CR251-4-5P750E          | 1          |            |                  |
| R455       | RES, MTL. FILM, 5K +/-1%, 1/8W     | 340240                | 91637               | CMF555001F              | 1          |            |                  |
| R456       | RES, DEP. CAR, 560 +/-5%, 1/4W     | 385948                | 80031               | CR251-4-5P560E          | 1          |            |                  |
| R457       | RES, MTL. FILM, 10K +/-1%, 1/8W    | 435065                | 91637               | CMF551002F              | 1          |            |                  |
| R458       | RES, MTL. FILM, 20K +/-1%, 1/8W    | 340620                | 91637               | CMF552002F              | 1          |            |                  |
| R459       | RES, CAR. DEP, 240K +/-5%, 1/4W    | 442459                | 80031               | CR251-4-5P240K          | 1          |            |                  |
| R461       | RES, MTL. FILM, 1M +/-1%, 1/8W     | 268797                | 91637               | MFF1-81004F             | REF        |            |                  |
| R462       | RES, MTL. FILM, 1.3K +/-1%, 1/8W   | 343921                | 91637               | CMF551301F              | REF        |            |                  |
| R463       | RES, VAR, 200K +/-10%, 1/2W        | 381921                | 32997               | 3299W-1-204             | REF        |            |                  |
| R464       | RES, MTL. FILM, 1K +/-1%, 1/8W     | 168229                | 91637               | CMF551001F              | REF        |            |                  |
| R466       | RES, COMP, 5.1 +/-5%, 1/4W         | 281832                | 01121               | CBR15                   | 1          |            |                  |
| R467       | RES, DEP. CAR, 300K +/-5%, 1/4W    | 441535                | 80031               | CR251-4-5P300K          | 3          |            |                  |
| R468       | RES, DEP. CAR, 3.6K +/-5%, 1/4W    | 442343                | 80031               | CR251-4-5P3K6           | 1          |            |                  |
| R470       | RES, MTL. FILM, 316K +/-1%, 1/8W   | 289496                | 91637               | CMF553163F              | 1          |            |                  |
| R472       | RES, DEP. CAR, 47K +/-5%, 1/4W     | 348896                | 80031               | CR251-4-5P47K           | 2          |            |                  |
| R473       | RES, DEP. CAR, 47K +/-5%, 1/4W     | 348896                | 80031               | CR251-4-5P47K           | REF        |            |                  |
| R474       | RES, DEP. CAR, 43K +/-5%, 1/4W     | 442418                | 80031               | CR251-4-5P43K           | 2          |            |                  |
| R475       | RES, DEP. CAR, 300K +/-5%, 1/4W    | 441535                | 80031               | CR251-4-5P300K          | REF        |            |                  |
| R476       | RES, DEP. CAR, 300K +/-5%, 1/4W    | 441535                | 80031               | CR251-4-5P300K          | REF        |            |                  |
| R477       | RES, DEP. CAR, 43K +/-5%, 1/4W     | 442418                | 80031               | CR251-4-5P43K           | REF        |            |                  |
| R478       | RES, DEP. CAR, 2K +/-5%, 1/4W      | 441469                | 80031               | CR251-4-5P2K            | REF        |            |                  |
| R479       | RES, DEP. CAR, 82 +/-5%, 1/4W      | 442277                | 80031               | CR251-4-5P82E           | 1          |            |                  |
| R480       | RES, MTL. FILM, 315K +/-1%, 1/8W   | 485375                | 91637               | CMF553153F              | 2          |            |                  |
| R481       | RES, VAR, 10 +/-10%, 0.5,3/4W      | 485458                | 89536               | 485458                  | REF        |            |                  |
| R482       | RES, DEP. CAR, 510 +/-5%, 1/4W     | 441600                | 80031               | CR251-4-5P510E          | REF        |            |                  |
| R483       | RES, MTL. FILM, 315K +/-1%, 1/8W   | 485375                | 91637               | CMF553153F              | REF        |            |                  |
| R488       | RES, DEP. CAR, 2K +/-5%, 1/4W      | 441469                | 80031               | CR251-4-5P2K            | REF        |            |                  |
| R489       | RES, DEP. CAR, 5.6 +/-5%, 1/4W     | 441618                | 80031               | CR251-4-5E6             | 1          |            |                  |
| R501       | RES, MTL. FILM, 6.49K +/-5%, 1/4W  | 294900                | 91637               | CMF 556491F             | 2          |            |                  |
| R502       | RES, MTL. FILM, 100 +/-1%, 1/8W    | 168195                | 91637               | CMF551000F              | 1          |            |                  |
| R503       | RES, VAR, CERMET, 5K +/-10%, 200V  | 493593                | 89536               | 493593                  | 2          | 1          |                  |
| R504       | RES, VAR, CERMET, 5K +/-10%, 200V  | 493593                | 89536               | 493593                  | REF        |            |                  |

Table 6-4. A3 Analog PCB Assembly (cont)

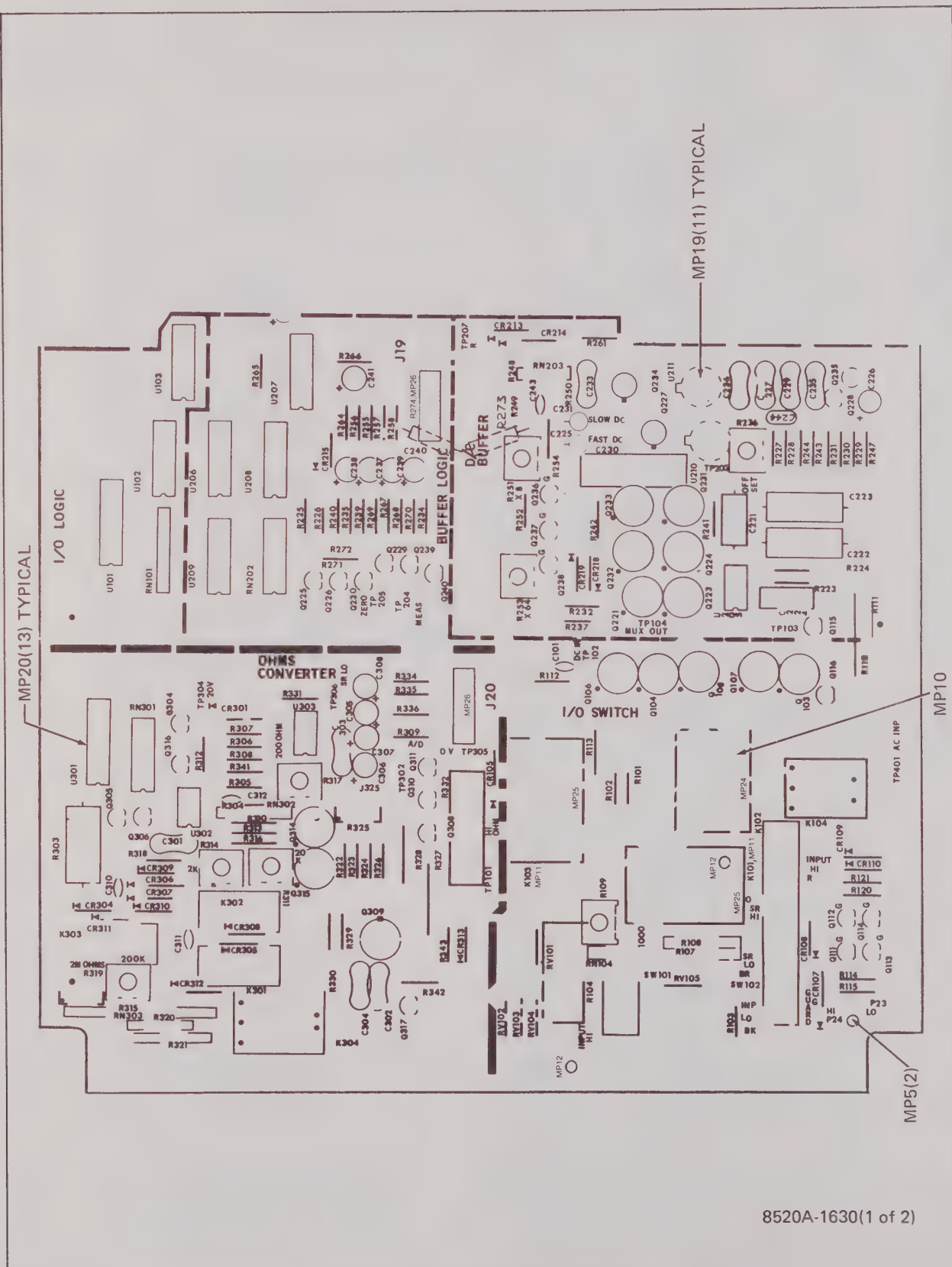
| REF<br>DES | DESCRIPTION                          | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|--------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| R505       | RES, MTL. FILM, 6.49K $\pm$ 1%, 1/8W | 289553                | 91637               | CMF556491F              | REF        |            |                  |
| R506       | RES, DEP. CAR, 27K $\pm$ 5%, 1/4W    | 441501                | 80031               | CR251-4-5P27K           | 2          |            |                  |
| R507       | RES, DEP. CAR, 20K $\pm$ 5%, 1/4W    | 441477                | 80031               | CR251-4-5P20K           | 2          |            |                  |
| R508       | RES, MTL. FILM, 6.49K $\pm$ 5%, 1/4W | 294900                | 91637               | CMF 556491F             | REF        |            |                  |
| R510       | RES, DEP. CAR, 27K $\pm$ 5%, 1/4W    | 441501                | 80031               | CR251-4-5P27K           | REF        |            |                  |
| R511       | RES, DEP. CAR, 20K $\pm$ 5%, 1/4W    | 441477                | 80031               | CR251-4-5P20K           | REF        |            |                  |
| R512       | RES, DEP. CAR, 1K $\pm$ 5%, 1/4W     | 343426                | 80031               | CR251-4-5P1K            | REF        |            |                  |
| R513       | RES, VAR, 100K $\pm$ 10%, 1/2W       | 369520                | 11236               | 360T-104A               | 1          | 1          |                  |
| R514       | RES, MTL. FILM, 1M $\pm$ 1%, 1/8W    | 268797                | 91637               | MFF1-81004F             | REF        |            |                  |
| R515       | RES, MTL. FILM, 133K $\pm$ 1%, 1/8W  | 289074                | 91637               | CMF551333F              | 1          |            |                  |
| R516       | RES, MTL. FILM, 143 $\pm$ 1%, 1/8W   | 192906                | 91637               | CMF551430F              | 1          |            |                  |
| R517       | RES, DEP. CAR, 1K $\pm$ 5%, 1/4W     | 343426                | 80031               | CR251-4-5P1K            | REF        |            |                  |
| R518       | RES, VAR, 1K $\pm$ 10%, 1/2W         | 275750                | 11236               | 360T102A                | REF        |            |                  |
| R519       | RES, VAR, 500 $\pm$ 10%, 1/2W        | 325613                | 11236               | 360T501A                | REF        |            |                  |
| R520       | RES, VAR, 100 $\pm$ 10%, 1/2W        | 275735                | 11236               | 360T101A                | REF        |            |                  |
| R521       | RES, VAR, 50 $\pm$ 10%, 1/2W         | 447862                | 11236               | 360T500A                | REF        |            |                  |
| R522       | RES, VAR, 20 $\pm$ 20%, 1/2W         | 275727                | 11236               | 360T-200B               | 1          | 1          |                  |
| R523       | RES, MTL. FILM, 26.7K $\pm$ 1%, 1/8W | 245779                | 91637               | CMF552672F              | 2          |            |                  |
| R524       | RES, MTL. FILM, 28.7K $\pm$ 1%, 1/8W | 235176                | 91637               | CMF552872F              | 1          |            |                  |
| R525       | RES, MTL. FILM, 33.2K $\pm$ 1%, 1/8W | 291393                | 91637               | CMF553322F              | 1          |            |                  |
| R526       | RES, MTL. FILM, 49.9K $\pm$ 1%, 1/8W | 268821                | 91637               | CMF554992F              | 1          |            |                  |
| R527       | RES, VAR, 100 $\pm$ 10%, 1/2W        | 275735                | 11236               | 360T101A                | REF        |            |                  |
| R528       | RES, DEP. CAR, 1.5K $\pm$ 5%, 1/4W   | 343418                | 80031               | CR251-4-5P1K5           | REF        |            |                  |
| R529       | RES, DEP. CAR, 510 $\pm$ 5%, 1/4W    | 441600                | 80031               | CR251-4-5P510E          | REF        |            |                  |
| R530       | RES, DEP. CAR, 15K $\pm$ 5%, 1/4W    | 348854                | 80031               | CR251-4-5P15K           | 1          |            |                  |
| R532       | RES, MTL. FILM, 26.7K $\pm$ 1%, 1/8W | 245779                | 91637               | CMF552672F              | REF        |            |                  |
| R534       | RES, DEP. CAR, 47 $\pm$ 5%, 1/4W     | 441592                | 80031               | CR251-4-5P47E           | 2          |            |                  |
| R535       | RES, DEP. CAR, 47 $\pm$ 5%, 1/4W     | 441592                | 80031               | CR251-4-5P47E           | REF        |            |                  |
| R538       | RES, MTL. FILM, 130 $\pm$ 1%, 1/8W   | 485698                | 91637               | CMF551300F              | 1          |            |                  |
| R539       | RES, MTL. FILM, 200 $\pm$ 1%, 1/8W   | 245340                | 91637               | MFF1-82000F             | 1          |            |                  |
| R601       | RES, DEP. CAR, 10K $\pm$ 5%, 1/4W    | 348839                | 80031               | CR251-4-5P10K           | REF        |            |                  |
| R602       | RES, MTL. FILM, 82.5K $\pm$ 1%, 1/8W | 246223                | 91637               | CMF558252F              | 1          |            |                  |
| R603       | RES, MTL. FILM 28.0K $\pm$ 1%, 1/8W  | 291385                | 91637               | CMF552802F              | 1          |            |                  |
| R604       | RES, DEP. CAR, 51 $\pm$ 5%, 1/4W     | 414540                | 80031               | CR251-4-5P51E           | 1          |            |                  |
| R606       | RES, DEP. CAR, 100K $\pm$ 5%, 1/4    | 348920                | 80031               | CR251-4-5P100K          | 1          |            |                  |
| R612       | RES, DEP. CAR, 1K $\pm$ 5%, 1/4W     | 343426                | 80031               | CR251-4-5P1K            | REF        |            |                  |
| R613       | RES, DEP. CAR, 10K $\pm$ 5%, 1/4W    | 348839                | 80031               | CR251-4-5P10K           | REF        |            |                  |
| R614       | RES, DEP. CAR, 10K $\pm$ 5%, 1/4W    | 348839                | 80031               | CR251-4-5P10K           | REF        |            |                  |
| R619       | RES, CAR. DEP, 820 $\pm$ 5%, 1/4W    | 442327                | 80031               | CR251-4-5P820E          | 1          |            |                  |
| R621       | RES, DEP. CAR, 10K $\pm$ 5%, 1/4W    | 348839                | 80031               | CR251-4-5P10K           | REF        |            |                  |
| R622       | RES, DEP. CAR, 1K $\pm$ 5%, 1/4W     | 343426                | 80031               | CR251-4-5P1K            | REF        |            |                  |
| R623       | RES, DEP. CAR, 1.2K $\pm$ 5%, 1/4W   | 441378                | 80031               | CR251-4-5P1K2           | 1          |            |                  |
| R709       | RES, WW, 0.1 $\pm$ 10%, 2W           | 485672                | 89536               | 485672                  | 1          |            |                  |
| R710       | RES, VAR, 50 $\pm$ 10%, 1/2W         | 447862                | 11236               | 360T500A                | REF        |            |                  |
| R711       | RES, DEP. CAR, 390 $\pm$ 5%, 1/2W    | 441543                | 80031               | CR251-4-5P390E          | REF        |            |                  |
| R712       | RES, DEP. CAR, 390 $\pm$ 5%, 1/2W    | 441543                | 80031               | CR251-4-5P390E          | REF        |            |                  |
| R713       | RES, DEP. CAR, 3.3K $\pm$ 5%, 1/4W   | 348813                | 80031               | CR251-4-5P3K3           | 2          |            |                  |
| R714       | RES, DEP. CAR, 3.3K $\pm$ 5%, 1/4W   | 348813                | 80031               | CR251-4-5P3K3           | REF        |            |                  |
| RN101      | RESISTOR NETWORK, 200K               | 485128                | 89536               | 485128                  | 1          |            |                  |
| RN104      | RESISTOR NETWORK ASSY                | 502955                | 89536               | 502955                  | 1          |            |                  |

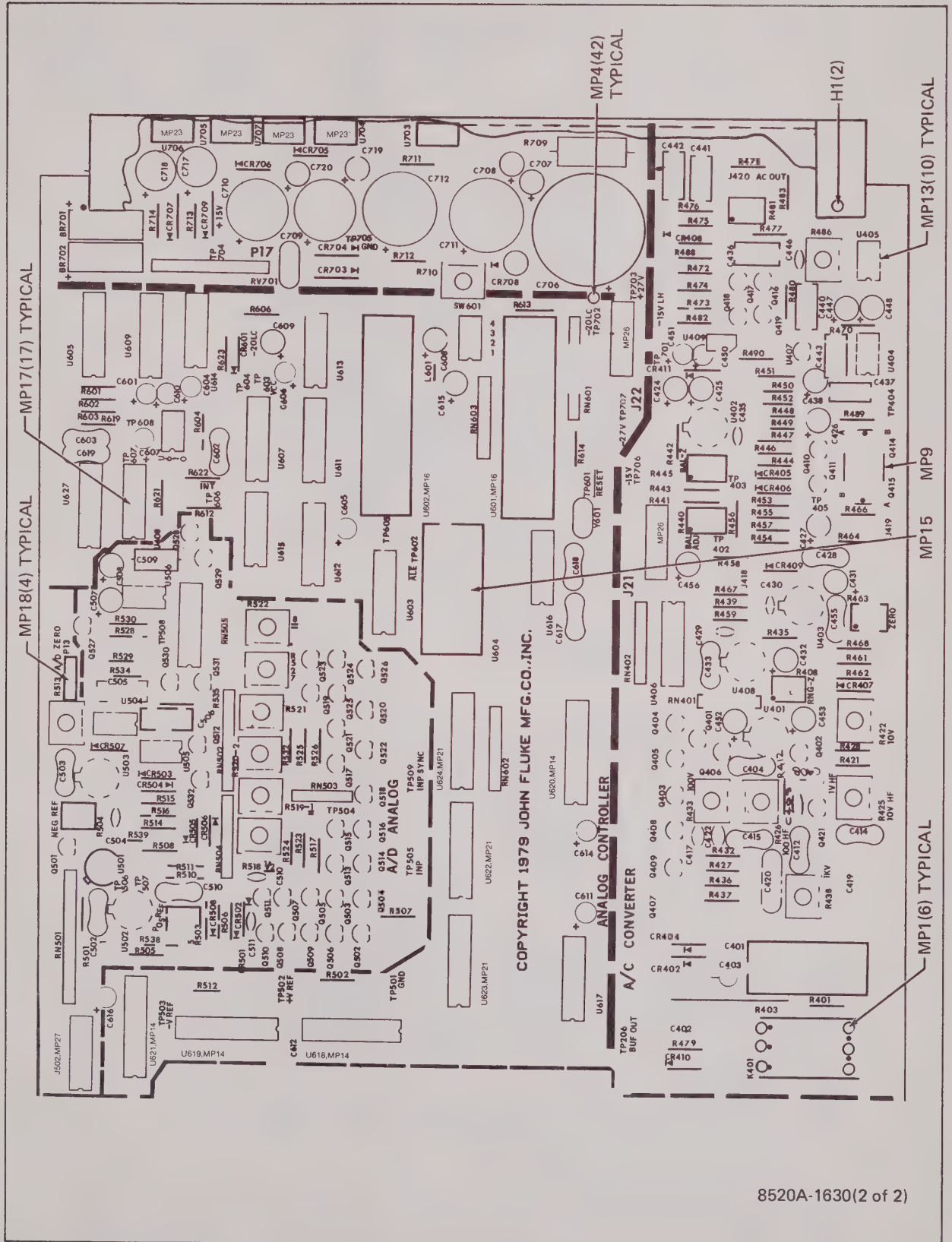
Table 6-4. A3 Analog PCB Assembly (cont)

| REF<br>DES | DESCRIPTION                              | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|------------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| RN202      | RESISTOR NETWORK, 100K                   | 516930                | 89536               | 516930                  | 2          |            |                  |
| RN203      | RESISTOR NETWORK ASSY                    | 502922                | 89536               | 502922                  | 1          |            |                  |
| RN301      | RESISTOR NETWORK, 100K                   | 516930                | 89536               | 516930                  | REF        |            |                  |
| RN302      | RESISTOR NETWORK ASSY                    | 502971                | 89536               | 502971                  | 1          |            |                  |
| RN401      | RESISTOR NETWORK, 22.0K                  | 520122                | 89536               | 520122                  | 1          |            |                  |
| RN402      | RESISTOR NETWORK                         | 412906                | 89536               | 412906                  | 1          |            |                  |
| RN501      | RESISTOR NETWORK ASSY                    | 502948                | 89536               | 502948                  | 1          |            |                  |
| RN502      | RESISTOR NETWORK ASSY                    | 502963                | 89536               | 502963                  | 1          |            |                  |
| RN503      | RESISTOR NETWORK, 100K                   | 412726                | 89536               | 412726                  | 1          |            |                  |
| RN504      | RESISTOR NETWORK, 100K                   | 412908                | 89536               | 412908                  | 1          |            |                  |
| RN506      | RESISTOR NETWORK, 100K                   | 380618                | 89536               | 380618                  | 1          |            |                  |
| RN601      | RESISTOR NETWORK, 10K                    | 414003                | 89536               | 414003                  | 1          |            |                  |
| RN602      | RESISTOR NETWORK, 10K                    | 412924                | 89536               | 412924                  | 2          |            |                  |
| RN603      | RESISTOR NETWORK, 10K                    | 412924                | 89536               | 412924                  | REF        |            |                  |
| RV101      | VARISTOR, 390V                           | 423475                | 09214               | V390M68                 | 2          | 1          |                  |
| RV102      | VARISTOR, 390V                           | 423475                | 09214               | V390M68                 | REF        |            |                  |
| RV103      | VARISTOR, 330V                           | 520874                | 09214               | V330MA5B                | 3          | 1          |                  |
| RV104      | VARISTOR, 330V                           | 520874                | 09214               | V330MA5B                | REF        |            |                  |
| RV105      | VARISTOR, 330V                           | 520874                | 09214               | V330MA5B                | REF        |            |                  |
| RV701      | VARISTOR, 33V                            | 485391                | 89536               | 485391                  | 1          | 1          |                  |
| SW101      | PUSHBUTTON SWITCH                        | 504852                | 89536               | 504852                  | 1          |            |                  |
| SW102      | PUSHBUTTON SWITCH                        | 504845                | 89536               | 504845                  | 1          |            |                  |
| U101       | XSTR, ARRAY, HIGH-VOLTAGE, HIGH-CURRENT  | 483081                | 01295               | ULN2004AN               | 1          | 1          |                  |
| U102       | IC, HIGH-VOLTAGE DISPLAY DRIVERS         | 504795                | 56289               | UPH-480                 | 2          | 1          |                  |
| U103       | IC, C-MOS, HEX OPEN DRAIN P-CHAN BUFFERS | 418947                | 12040               | MM74C907N               | 2          | 1          |                  |
| U205       | IC, LINEAR, OP-AMP                       | 472779                | 12040               | LF356N                  | 1          | 1          |                  |
| U206       | IC, C-MOS, HEX OPEN DRAIN P-CHAN BUFFERS | 418947                | 12040               | MM74C907N               | REF        |            |                  |
| U207       | IC, C-MOS, HEX, INVERTER                 | 404699                | 12040               | MM74C04N                | 3          | 1          |                  |
| U208       | IC, TTL, POS NAND GATES AND INVERTERS    | 394205                | 01295               | SN74LS03N               | 1          | 1          |                  |
| U209       | IC, HIGH-VOLTAGE DISPLAY DRIVERS         | 504795                | 56289               | UPH-480                 | REF        |            |                  |
| U210       | IC, LIN, OP-AMP, HIGH SUPPLY VOLTAGE     | 392902                | 04713               | MC1436G                 | 2          | 1          |                  |
| U211       | IC, LIN, OP-AMP, HIGH SUPPLY VOLTAGE     | 392902                | 04713               | MC1436G                 | REF        |            |                  |
| U301       | XSTR, LIN, ARRAY, 2-PNP, 16-PIN DIP      | 418954                | 02735               | CA3096E                 | 1          | 1          |                  |
| U302       | IC, LIN, OP-AMP                          | 478107                | 12040               | 308A                    | 2          | 1          |                  |
| U303       | IC, LIN, OP-AMP                          | 478107                | 12040               | 308A                    | REF        |            |                  |
| U401       | IC, LIN, OP-AMP, J-FET INPUT             | 495101                | 89536               | 495101                  | 1          | 1          |                  |
| U402       | IC, LIN, OP-AMP, J-FET INPUT             | 477869                | 12040               | LF357H                  | 1          | 1          |                  |
| U403       | IC, LIN, OP-AMP                          | 429837                | 12040               | LF356H                  | 1          | 1          |                  |
| U404       | IC, LIN, J-FET                           | 495119                | 12040               | LF353BN                 | 1          | 1          |                  |
| U405       | IC, LIN, OP-AMP, J-FET INPUT             | 483305                | 12040               | LF351B                  | 1          | 1          |                  |
| U406       | IC, HIGH-VOLTAGE DISPLAY DRIVERS         | 504894                | 56289               | UPH-481                 | 1          | 1          |                  |
| U407       | IC, VOLTAGE REGULATOR, POS               | 429647                | 07263               | A78L08AWC               | 1          | 1          |                  |
| U408       | IC, LIN, OP-AMP, METAL CAN               | 288928                | 12040               | LM308AH                 | 3          | 1          |                  |
| U409       | IC, LIN, NEG VOLTAGE REULATOR            | 407635                | 04713               | MC7908CP                | 1          | 1          |                  |
| U501       | ZENER REF AMP                            | 510669                | 89536               | 510669                  | 1          | 1          | A                |
| U502       | IC, LIN, OP-AMP, METAL CAN               | 288928                | 12040               | LM308AH                 | REF        |            |                  |
| U503       | IC, LIN, OP-AMP, METAL CAN               | 288928                | 12040               | LM308AH                 | REF        |            |                  |
| U504       | IC, OPERATIONAL AMP, J-FET INPUT         | 418780                | 12040               | LF351N                  | 3          | 1          |                  |
| U505       | IC, OPERATIONAL AMP, J-FET INPUT         | 418780                | 12040               | LF351N                  | REF        |            |                  |
| U506       | IC, OPERATIONAL AMP, J-FET INPUT         | 418780                | 12040               | LF351N                  | REF        |            |                  |

Table 6-4. A3 Analog PCB Assembly (cont)

| REF<br>DES                                                 | DESCRIPTION                              | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------------------------------------------------------|------------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| U601                                                       | IC, N-CHAN SIL GATE, 8-BIT               | 524496                | 89536               | 524496                  | 1          | 1          |                  |
| U602                                                       | IC, C-MOS, ASYNCRNS, REC/TRANSMITTER     | 453464                | 32293               | IM6402CPL               | 1          | 1          |                  |
| U603                                                       | IC, C-MOS, HEX, "D" TYPE F/F             | 404509                | 02735               | CD40174BE               | 3          | 1          |                  |
| U604                                                       | IC, MSI, TTL, DECODER/MULTIPLEXER        | 404152                | 01295               | SN74L154N               | 1          | 1          |                  |
| U605                                                       | IC, C-MOS, DUAL UP COUNTER               | 355164                | 04713               | MC14520CL/CP            | 1          | 1          |                  |
| U607                                                       | IC, C-MOS, HEX, "D" TYPE F/F             | 404509                | 02735               | CD40174BE               | REF        |            |                  |
| U608                                                       | IC, C-MOS, 74C, DUAL "D" F/F             | 418830                | 12040               | MM74C74                 | 1          | 1          |                  |
| U609                                                       | IC, TTL, LO-PWR, SNGL/DUAL RETRIG        | 404186                | 01295               | SN74LS123N              | 1          | 1          |                  |
| U610                                                       | IC, TTL, DUAL PERIPHERAL DRIVER          | 329706                | 01295               | SN75452P                | 1          | 1          |                  |
| U611                                                       | IC, C-MOS, TRI-STATE, HEX NONINV BFFRS   | 407759                | 12040               | MM80C97N                | 2          | 1          |                  |
| U612                                                       | IC, C-MOS, TRI-STATE, HEX NONINV BFFRS   | 407759                | 12040               | MM80C97N                | REF        |            |                  |
| U613                                                       | IC, TTL, QUAD, 2-INPUT, POS AND GATES    | 393066                | 01295               | SN74LS08N               | 1          | 1          |                  |
| U614                                                       | IC, C-MOS, HEX, INVERTER                 | 404699                | 12040               | MM74C04N                | REF        |            |                  |
| U615                                                       | IC, TTL, HEX INVERTER, OPEN COLLECTOR    | 394536                | 01295               | SN74LS05N               | 1          | 1          |                  |
| U616                                                       | IC, C-MOS, HEX, INVERTER                 | 404699                | 12040               | MM74C04N                | REF        |            |                  |
| U617                                                       | IC, C-MOS, HEX, "D" TYPE F/F             | 404509                | 02735               | CD40174BE               | REF        |            |                  |
| U618                                                       | IC, TTL LO-PWR SCHTKY OCTAL "D" TYPE F/F | 454892                | 01295               | SN74LS273N              | 4          | 1          |                  |
| U619                                                       | IC, TTL LO-PWR SCHTKY OCTAL "D" TYPE F/F | 454892                | 01295               | SN74LS273N              | REF        |            |                  |
| U620                                                       | IC, TTL LO-PWR SCHTKY OCTAL "D" TYPE F/F | 454892                | 01295               | SN74LS273N              | REF        |            |                  |
| U621                                                       | IC, TTL LO-PWR SCHTKY OCTAL "D" TYPE F/F | 454892                | 01295               | SN74LS273N              | REF        |            |                  |
| U622                                                       | IC, HIGH VOLTAGE DISPLAY DRIVERS         | 504902                | 56289               | UPH-482                 | 3          | 1          |                  |
| U623                                                       | IC, HIGH VOLTAGE DISPLAY DRIVERS         | 504902                | 56289               | UPH-482                 | REF        |            |                  |
| U624                                                       | IC, HIGH VOLTAGE DISPLAY DRIVERS         | 504902                | 56289               | UPH-482                 | REF        |            |                  |
| U627                                                       | XSTR, PULSE TYPE, DIP PACKAGE            | 500298                | 32997               | 4252-1034               | 1          | 1          |                  |
| U703                                                       | IC, LIN VOLT REG, FIXED VOLTAGES         | 428847                | 04713               | MC7805TP                | 1          | 1          |                  |
| U704                                                       | IC, LIN, VOLT REG, FIXED VOLTAGES        | 413195                | 04713               | MC7812TP                | 1          | 1          |                  |
| U705                                                       | IC, LINEAR, VOL REF, RCD                 | 413187                | 04713               | MC7815TP                | 1          | 1          |                  |
| U706                                                       | IC, LINEAR, NEG VOL REG                  | 413179                | 04713               | MC7915                  | 1          | 1          |                  |
| U707                                                       | IC, LIN, NEG VOLT REG, FIXED VOLTAGES    | 381665                | 04713               | MC7912CT                | 1          | 1          |                  |
| Y601                                                       | CRYSTAL, 6 MHZ, +/-0.015%                | 461665                | 89536               | 461665                  | 1          | 1          |                  |
| NOTE: THE ANALOG PCB ASSEMBLY IS<br>DIVIDED INTO SECTIONS: |                                          |                       |                     |                         |            |            |                  |
| -1 INPUT/OUTPUT SWITCHING<br>(100 SERIES COMPONENTS)       |                                          |                       |                     |                         |            |            |                  |
| -2 DC BUFFER & DC BUFFER LOGIC<br>(200 SERIES COMPONENTS)  |                                          |                       |                     |                         |            |            |                  |
| -3 OHMS CONVERTER<br>(300 SERIES COMPONENTS)               |                                          |                       |                     |                         |            |            |                  |
| -4 AC CONVERTER (400 SERIES COMPONENTS)                    |                                          |                       |                     |                         |            |            |                  |
| -5 A/D ANALOG (500 SERIES COMPONENTS)                      |                                          |                       |                     |                         |            |            |                  |
| -6 ANALOG CONTROLLER<br>(600 SERIES COMPONENTS)            |                                          |                       |                     |                         |            |            |                  |
| -7 POWER SUPPLY (700 SERIES COMPONENTS)                    |                                          |                       |                     |                         |            |            |                  |
| EACH SECTION HAS ITS' OWN SPECIFIC SERIES.                 |                                          |                       |                     |                         |            |            |                  |
| A ONE OF THESE THREE ITEMS WILL<br>BE INSTALLED.           |                                          |                       |                     |                         |            |            |                  |



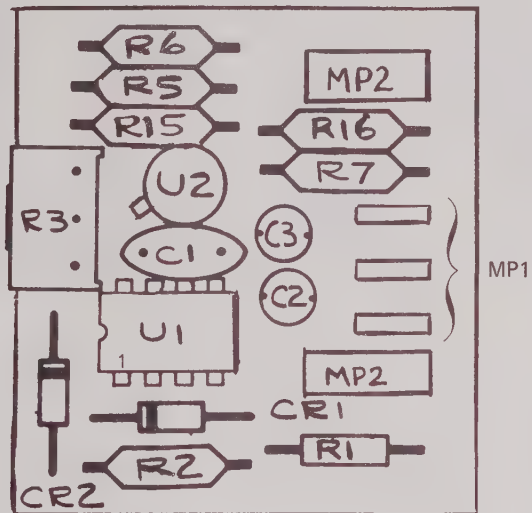


8520A-1630(2 of 2)

Figure 6-4. A3 Analog PCB Assembly (cont)

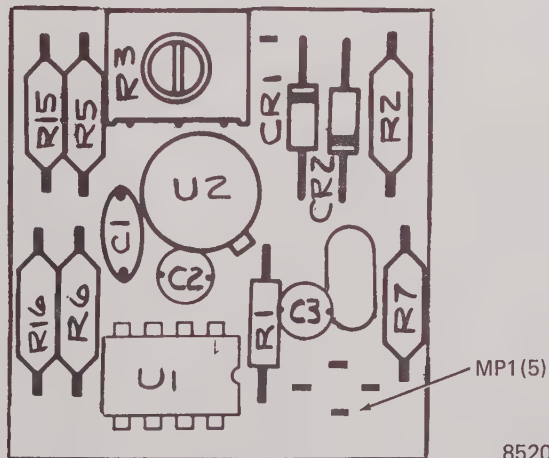
Table 6-5. A3A1 Reference Module

| REF<br>DES                                                                 | DESCRIPTION                                               | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|----------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| A3A1                                                                       | REFERENCE MODULE (VERTICAL)<br>FIGURE 6-5 (8520A-4046T)   | 530626                | 89536               | 530626                  | AR         |            | A                |
| C1                                                                         | CAP, CER, 2000 PF GMV, 1 KV                               | 105569                | 71590               | DA140-139CB             | 1          |            |                  |
| C2                                                                         | CAP, TA, 2.2 UF +/-20%, 20V                               | 161927                | 56289               | 196D2225X0020HA1        | 2          |            |                  |
| C3                                                                         | CAP, TA, 2.2 UF +/-20%, 20V                               | 161927                | 56289               | 196D2225X0020HA1        | REF        |            |                  |
| CR1                                                                        | DIODE, HI SPEED SWITCHING                                 | 203323                | 07910               | 1N4448                  | 2          | 1          |                  |
| CR2                                                                        | DIODE, HI SPEED SWITCHING                                 | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| MP1                                                                        | CONNECTOR, POST                                           | 375329                | 89536               | 375329                  | 3          |            |                  |
| MP2                                                                        | TEST JACK (RED)                                           | 170480                | 74970               | 105-752                 | 2          |            |                  |
| R1                                                                         | RES, DEP. CAR, 1M +/-5%, 1/4W                             | 348987                | 80031               | CR251-4-5P1M            | 1          |            |                  |
| R2                                                                         | RES, MTL. FILM, 3.74K +/-1%, 1/8W                         | 260547                | 91637               | CMF553741F              | 1          |            |                  |
| R3                                                                         | RES, VAR, 2K +/-10%, 1/2W                                 | 285163                | 11236               | 360S202A                | 1          | 1          |                  |
| R5                                                                         | RES, MTL. FILM, 15.4K +/-1%, 1/8W                         | 340604                | 91637               | CMF551542F              | 1          |            |                  |
| R6                                                                         | RES, MTL. FILM, 10.05K +/-1%, 1/8W                        | 340216                | 89536               | 340216                  | 1          |            |                  |
| R7                                                                         | RES, MTL. FILM, 4.02K +/-1%, 1/8W                         | 235325                | 91637               | CMF554021F              | 1          |            |                  |
| R15                                                                        | REF AMP SET<br>(R15,R16,U2)                               | 523407                | 89536               | 523407                  | 1          | 1          | B                |
| R16                                                                        | PART OF R15 SET                                           |                       |                     |                         |            |            |                  |
| U1                                                                         | IC, J-FET INPUT, DUAL, OPERAT. AMPLIFIER                  | 495119                | 12040               | LF353BN                 | 1          | 1          |                  |
| U2                                                                         | PART OF R15 SET                                           |                       |                     |                         |            |            |                  |
| A INSTALLED PER CUSTOMER REQUIREMENTS.                                     |                                                           |                       |                     |                         |            |            |                  |
| B R15, R16 RESISTORS (REF AMP SET)<br>CAN BE INSTALLED IN EITHER POSITION. |                                                           |                       |                     |                         |            |            |                  |
| A3A1                                                                       | REFERENCE MODULE (HORIZONTAL)<br>FIGURE 6-5 (8520A-4045T) | 527994                | 89536               | 527994                  | AR         |            | A                |
| C1                                                                         | CAP, CER, 2000 PF GMV, 1KV                                | 105569                | 71590               | DA140-139CB             | 1          |            |                  |
| C2                                                                         | CAP, TA, 2.2 UF +/-20%, 20V                               | 161927                | 56289               | 196D2225X0020HA1        | 2          |            |                  |
| C3                                                                         | CAP, TA, 2.2 UF +/-20%, 20V                               | 161927                | 56289               | 196D2225X0020HA1        | REF        |            |                  |
| CR1                                                                        | DIODE, HI SPEED SWITCHING                                 | 203323                | 07910               | 1N4448                  | 2          | 1          |                  |
| CR2                                                                        | DIODE, HI SPEED SWITCHING                                 | 203323                | 07910               | 1N4448                  | REF        |            |                  |
| MP1                                                                        | CONNECTOR, POST                                           | 267633                | 00779               | 86144-1                 | 5          |            |                  |
| R1                                                                         | RES, DEP. CAR, 1M +/-5%, 1/4W                             | 348987                | 80031               | CR251-4-5P1M            | 1          |            |                  |
| R2                                                                         | RES, MTL. FILM, 3.74K +/-1%, 1/8W                         | 260547                | 91637               | CMF553741F              | 1          |            |                  |
| R3                                                                         | RES, VAR, 2K +/-10%, 1/2W                                 | 309666                | 11236               | 360T202A                | 1          | 1          |                  |
| R5                                                                         | RES, MTL. FILM, 15.4K +/-1%, 1/4W                         | 340604                | 91637               | CMF551542F              | 1          |            |                  |
| R6                                                                         | RES, MTL. FILM, 10.05K +/-1%, 1/8W                        | 340216                | 89536               | 340216                  | 1          |            |                  |
| R7                                                                         | RES, MTL. FILM, 4.02K +/-1%, 1/8W                         | 235325                | 91637               | CMF554021F              | 1          |            |                  |
| R15                                                                        | REF AMP SET<br>(R15,R16,U2)                               | 523407                | 89536               | 523407                  | 1          | 1          | B                |
| R16                                                                        | PART OF R15 REF AMP SET                                   |                       |                     |                         |            |            |                  |
| U1                                                                         | IC, J-FET INPUT, DUAL, OPERAT. AMPLIFIER                  | 495119                | 12040               | LF353BN                 | 1          | 1          |                  |
| U2                                                                         | PART OF R15 REF AMP SET                                   |                       |                     |                         |            |            |                  |
| A INSTALLED PER CUSTOMER REQUIREMENTS                                      |                                                           |                       |                     |                         |            |            |                  |
| B R15, R16 (TO REF AMP SET) CAN BE<br>INSTALLED IN EITHER POSITION.        |                                                           |                       |                     |                         |            |            |                  |



8520A-1646

HORIZONTAL



8520A-1645

VERTICAL

Figure 6-5. A3A1 Reference Module

Table 6-6. A4 Transformer Assembly

| REF<br>DES | DESCRIPTION                                         | FLUKE<br>STOCK<br>NO. | MFG<br>SPLY<br>CODE | MFG PART NO.<br>OR TYPE | TOT<br>QTY | REC<br>QTY | N<br>O<br>T<br>E |
|------------|-----------------------------------------------------|-----------------------|---------------------|-------------------------|------------|------------|------------------|
| A4         | TRANSFORMER ASSEMBLY<br>FIGURE 6-6 (8520A-4202)     | 496869                | 89536               | 496869                  |            |            | REF              |
| A4A1       | TRANSFORMER PCB ASSEMBLY                            | ORDER                 | ONLY                | REPLACEABLE PARTS       | 1          |            |                  |
| H1         | SCREW, #8-32 X 1/4                                  | 228890                | 89536               | 228890                  | 4          |            |                  |
| MP1        | BRACKET, XFMR, FRONT                                | 491118                | 89536               | 491118                  | 1          |            |                  |
| MP2        | BRACKET, XFMR, REAR                                 | 491126                | 89536               | 491126                  | 1          |            |                  |
| MP3        | GROMMET                                             | 100065                | 89536               | 100065                  | 1          |            |                  |
| T1         | TRANSFORMER                                         | 490797                | 89536               | 490797                  | 1          |            |                  |
| A4A1       | TRANSFORMER PCB ASSEMBLY<br>FIGURE 6-6 (8520A-4040) | ORDER                 | ONLY                | REPLACEABLE PARTS       |            |            | REF              |
| C1         | CAP, CER, 0.22 UF +/-20%, 50V                       | 309849                | 71590               | CW30C224K               | 2          |            |                  |
| C2         | CAP, CER, 0.22 UF +/-20%, 50V                       | 309849                | 71590               | CW30C224K               |            |            | REF              |
| CR1        | DIODE, SI, HIGH VOLTAGE                             | 325746                | 04713               | MR751                   | 2          |            |                  |
| CR2        | DIODE, SI, HIGH VOLTAGE                             | 325746                | 04713               | MR751                   |            |            | REF              |
| L1         | CHOKE                                               | 492116                | 89536               | 492116                  | 1          |            |                  |
| P1         | CONNECTOR                                           | 512889                | 02660               | 62395-1834              | 2          |            |                  |
| P2         | CONNECTOR                                           | 512889                | 02660               | 62395-1834              |            |            | REF              |
| RV1        | VARISTOR, 33V                                       | 485391                | 89536               | 485391                  | 1          |            |                  |
| RV2        | VARISTOR, 22V                                       | 500777                | 89536               | 500777                  | 1          |            |                  |
| SW1        | SWITCH, SLIDE, DPDT                                 | 234278                | 89536               | 234278                  | 2          |            |                  |
| SW2        | SWITCH, SLIDE, DPDT                                 | 234278                | 89536               | 234278                  |            |            | REF              |

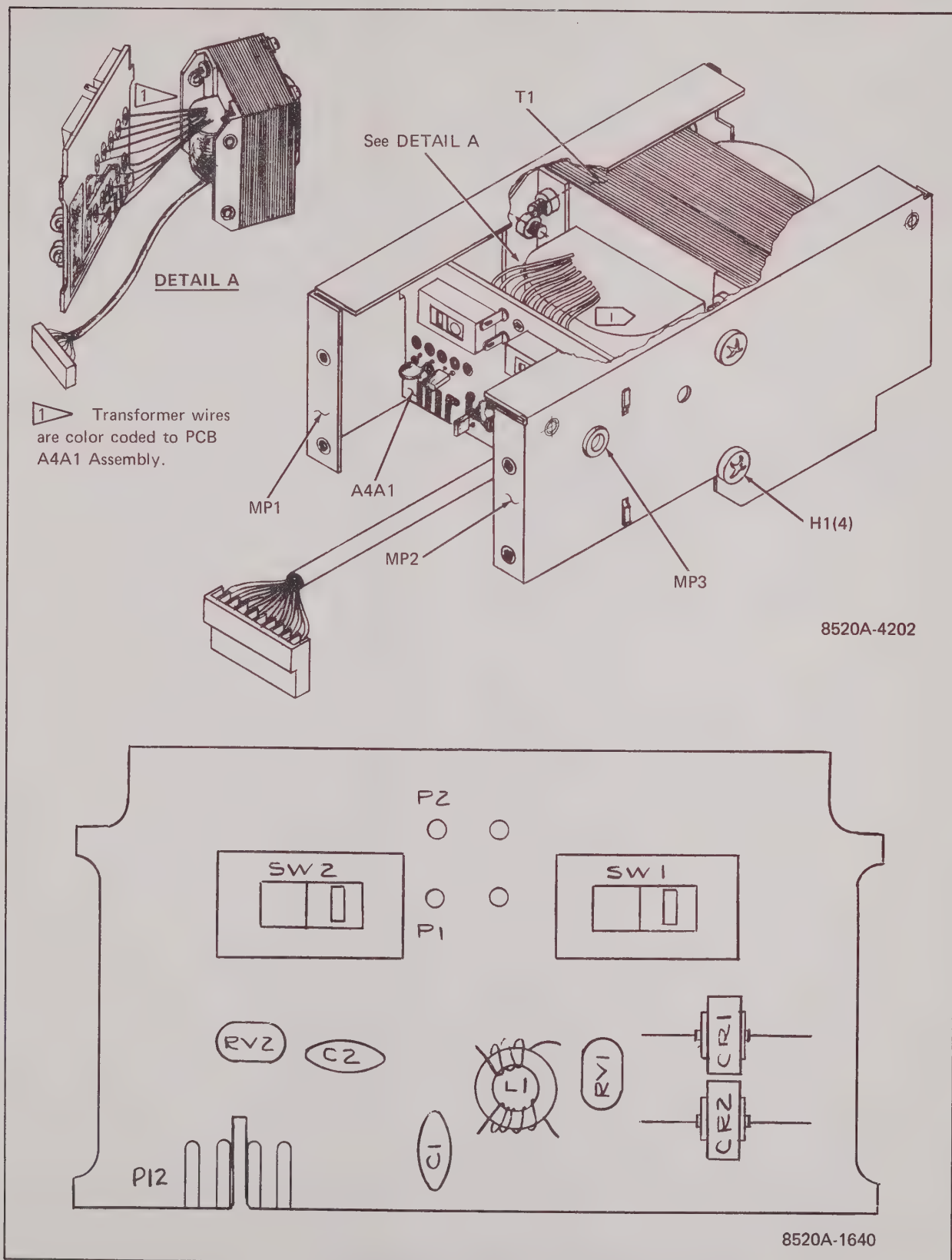


Figure 6-6. A4 Transformer Assembly



## **Section 7**

# **General Information**

7-1. This section of the manual contains generalized user information as well as supplemental information to the List of Replaceable Parts contained in Section 6. The following information is presented in this section:

List of Abbreviations

Federal Supply Codes for Manufacturers

## List of Abbreviations and Symbols

|                 |                             |                   |                            |                   |                                                     |
|-----------------|-----------------------------|-------------------|----------------------------|-------------------|-----------------------------------------------------|
| <b>A or amp</b> | ampere                      | <b>hf</b>         | high frequency             | <b>(+) or pos</b> | positive                                            |
| <b>ac</b>       | alternating current         | <b>Hz</b>         | hertz                      | <b>pot</b>        | potentiometer                                       |
| <b>af</b>       | audio frequency             | <b>IC</b>         | integrated circuit         | <b>p-p</b>        | peak-to-peak                                        |
| <b>a/d</b>      | analog-to-digital           | <b>lf</b>         | intermediate frequency     | <b>ppm</b>        | parts per million                                   |
| <b>assy</b>     | assembly                    | <b>in</b>         | inch(es)                   | <b>PROM</b>       | programmable read-only memory                       |
| <b>AWG</b>      | american wire gauge         | <b>intl</b>       | internal                   | <b>psi</b>        | pound-force per square inch                         |
| <b>B</b>        | bel                         | <b>I/O</b>        | input/output               | <b>RAM</b>        | random-access memory                                |
| <b>bcd</b>      | binary coded decimal        | <b>k</b>          | kilo (10 <sup>3</sup> )    | <b>rf</b>         | radio frequency                                     |
| <b>°C</b>       | Celsius                     | <b>kHz</b>        | kilohertz                  | <b>rms</b>        | root mean square                                    |
| <b>cap</b>      | capacitor                   | <b>kΩ</b>         | kilohm(s)                  | <b>ROM</b>        | read-only memory                                    |
| <b>ccw</b>      | counterclockwise            | <b>kV</b>         | kilovolt(s)                | <b>s or sec</b>   | second (time)                                       |
| <b>cer</b>      | ceramic                     | <b>lf</b>         | low frequency              | <b>scope</b>      | oscilloscope                                        |
| <b>cermet</b>   | ceramic to metal(seal)      | <b>LED</b>        | light-emitting diode       | <b>SH</b>         | shield                                              |
| <b>ckt</b>      | circuit                     | <b>LSB</b>        | least significant bit      | <b>Si</b>         | silicon                                             |
| <b>cm</b>       | centimeter                  | <b>LSD</b>        | least significant digit    | <b>serno</b>      | serial number                                       |
| <b>cmrr</b>     | common mode rejection ratio | <b>M</b>          | mega (10 <sup>6</sup> )    | <b>sr</b>         | shift register                                      |
| <b>comp</b>     | composition                 | <b>m</b>          | milli (10 <sup>-3</sup> )  | <b>Ta</b>         | tantalum                                            |
| <b>cont</b>     | continue                    | <b>mA</b>         | milliampere(s)             | <b>tb</b>         | terminal board                                      |
| <b>crt</b>      | cathode-ray tube            | <b>max</b>        | maximum                    | <b>tc</b>         | temperature coefficient or temperature compensating |
| <b>cw</b>       | clockwise                   | <b>mf</b>         | metal film                 | <b>tcxo</b>       | temperature compensated crystal oscillator          |
| <b>d/a</b>      | digital-to-analog           | <b>MHz</b>        | megahertz                  | <b>tp</b>         | test point                                          |
| <b>dac</b>      | digital-to-analog converter | <b>min</b>        | minimum                    | <b>u or μ</b>     | micro (10 <sup>-6</sup> )                           |
| <b>dB</b>       | decibel                     | <b>mm</b>         | millimeter                 | <b>uhf</b>        | ultra high frequency                                |
| <b>dc</b>       | direct current              | <b>ms</b>         | millisecond                | <b>us or μs</b>   | microsecond(s) (10 <sup>-6</sup> )                  |
| <b>dmm</b>      | digital multimeter          | <b>MSB</b>        | most significant bit       | <b>uut</b>        | unit under test                                     |
| <b>dvm</b>      | digital voltmeter           | <b>MSD</b>        | most significant digit     | <b>V</b>          | volt                                                |
| <b>elect</b>    | electrolytic                | <b>MTBF</b>       | mean time between failures | <b>v</b>          | voltage                                             |
| <b>ext</b>      | external                    | <b>MTTR</b>       | mean time to repair        | <b>var</b>        | variable                                            |
| <b>F</b>        | farad                       | <b>mV</b>         | millivolt(s)               | <b>vco</b>        | voltage controlled oscillator                       |
| <b>°F</b>       | Fahrenheit                  | <b>mv</b>         | multivibrator              | <b>vhf</b>        | very high frequency                                 |
| <b>FET</b>      | Field-effect transistor     | <b>MΩ</b>         | megohm(s)                  | <b>vlf</b>        | very low frequency                                  |
| <b>ff</b>       | flip-flop                   | <b>n</b>          | nano (10 <sup>-9</sup> )   | <b>W</b>          | watt(s)                                             |
| <b>freq</b>     | frequency                   | <b>na</b>         | not applicable             | <b>ww</b>         | wire wound                                          |
| <b>FSN</b>      | federal stock number        | <b>NC</b>         | normally closed            | <b>xfmr</b>       | transformer                                         |
| <b>g</b>        | gram                        | <b>(-) or neg</b> | negative                   | <b>xstr</b>       | transistor                                          |
| <b>G</b>        | giga (10 <sup>9</sup> )     | <b>NO</b>         | normally open              | <b>xtal</b>       | crystal                                             |
| <b>gd</b>       | guard                       | <b>ns</b>         | nanosecond                 | <b>xtlo</b>       | crystal oscillator                                  |
| <b>Ge</b>       | germanium                   | <b>opnl ampli</b> | operational amplifier      | <b>Ω</b>          | ohm(s)                                              |
| <b>GHz</b>      | gigahertz                   | <b>p</b>          | pico (10 <sup>-12</sup> )  | <b>μ</b>          | micro (10 <sup>-6</sup> )                           |
| <b>gmV</b>      | guaranteed minimum value    | <b>para</b>       | paragraph                  |                   |                                                     |
| <b>gnd</b>      | ground                      | <b>pcb</b>        | printed circuit board      |                   |                                                     |
| <b>H</b>        | henry                       | <b>pF</b>         | picofarad                  |                   |                                                     |
| <b>hd</b>       | heavy duty                  | <b>pn</b>         | part number                |                   |                                                     |

## Federal Supply Codes for Manufacturers

|                                                                                                                         |                                                                                                          |                                                                                                               |                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| 00213<br>Nytronics Comp. Group Inc.<br>Subsidiary of Nytronics Inc.<br>Formerly Sage Electronics<br>Rochester, New York | 02660<br>Bunker Ramo Corp., Conn Div.<br>Formerly Amphenol-Borg<br>Electric Corp.<br>Broadview, Illinois | 04946<br>Standard Wire & Cable<br>Los Angeles, California                                                     | 06751<br>Components, Inc. Semcor Div.<br>Phoenix, Arizona                                                           |
| 00327<br>Welwyn International, Inc.<br>Westlake, Ohio                                                                   | 02799<br>Areo Capacitors, Inc.<br>Chatsworth, California                                                 | 05082<br>Replaced by 94988                                                                                    | 06860<br>Gould Automotive Div.<br>City of Industry, California                                                      |
| 00656<br>Aerovox Corp.<br>New Bedford, Massachusetts                                                                    | 03508<br>General Electric Co.<br>Semiconductor Products<br>Syracuse, New York                            | 05236<br>Jonathan Mfg. Co.<br>Fullerton, California                                                           | 06961<br>Vernitron Corp., Piezo<br>Electric Div.<br>Formerly Clevite Corp., Piezo<br>Electric Div.<br>Bedford, Ohio |
| 00686<br>Film Capacitors, Inc.<br>Passaic, New Jersey                                                                   | 03614<br>Replaced by 71400                                                                               | 05245<br>Components Corp. now<br>Corcom, Inc.<br>Chicago, Illinois                                            | 06980<br>Eimac Div.<br>Varian Associates<br>San Carlos, California                                                  |
| 00779<br>AMP Inc.<br>Harrisburg, Pennsylvania                                                                           | 03651<br>Replaced by 44655                                                                               | 05277<br>Westinghouse Electric Corp.<br>Semiconductor Div.<br>Youngwood, Pennsylvania                         | 07047<br>The Ross Milton Co.<br>South Hampton, Pennsylvania                                                         |
| 01121<br>Allen-Bradley Co.<br>Milwaukee, Wisconsin                                                                      | 03797<br>Eldema Div.<br>Genisco Technology Corp.<br>Compton, California                                  | 05278<br>Replaced by 43543                                                                                    | 07115<br>Replaced by 14674                                                                                          |
| 01281<br>TRW Electronic Comp.<br>Semiconductor Operations<br>Lawndale, California                                       | 03877<br>Transistron Electronic Corp.<br>Wakefield, Massachusetts                                        | 05279<br>Southwest Machine &<br>Plastic Co.<br>Glendora, California                                           | 07138<br>Westinghouse Electric Corp.,<br>Electronic Tube Div.<br>Horsehead, New York                                |
| 01295<br>Texas Instruments, Inc.<br>Semiconductor Group<br>Dallas, Texas                                                | 03888<br>KDI Pyrofilm Corp.<br>Whippany, New Jersey                                                      | 05397<br>Union Carbide Corp.<br>Materials Systems Div.<br>New York, New York                                  | 07233<br>TRW Electronic Components<br>Cinch Graphic<br>City of Industry, California                                 |
| 01537<br>Motorola Communications &<br>Electronics Inc.<br>Franklin Park, Illinois                                       | 03911<br>Clairex Electronics Div.<br>Clairex Corp.<br>Mt. Vernon, New York                               | 05571<br>Use 56289<br>Sprague Electric Co.<br>Pacific Div.<br>Los Angeles, California                         | 07256<br>Silicon Transistor Corp.<br>Div. of BBF Group Inc.<br>Chelmsford, Massachusetts                            |
| 01686<br>RCL Electronics Inc.<br>Manchester, New Hampshire                                                              | 03980<br>Muirhead Inc.<br>Mountainside, New Jersey                                                       | 05574<br>Viking Industries<br>Chatsworth, California                                                          | 07261<br>Aumet Corp.<br>Culver City, California                                                                     |
| 01730<br>Replaced by 73586                                                                                              | 04009<br>Arrow Hart Inc.<br>Hartford, Connecticut                                                        | 05704<br>Replaced by 16258                                                                                    | 07263<br>Fairchild Semiconductor<br>Div. of Fairchild Camera<br>& Instrument Corp.<br>Mountain View, California     |
| 01884<br>Use 56289<br>Sprague Electric Co.<br>Dearborn Electronic Div.<br>Lockwood, Florida                             | 04062<br>Replaced by 72136                                                                               | 05820<br>Wakefield Engineering Inc.<br>Wakefield, Massachusetts                                               | 07344<br>Bircher Co., Inc.<br>Rochester, New York                                                                   |
| 02114<br>Ferroxcube Corp.<br>Saugerties, New York                                                                       | 04202<br>Replaced by 81312                                                                               | 06001<br>General Electric Co.<br>Electronic Capacitor &<br>Battery Products Dept.<br>Columbia, South Carolina | 07597<br>Burndy Corp.<br>Tape/Cable Div.<br>Rochester, New York                                                     |
| 02131<br>General Instrument Corp.<br>Harris ASW Div.<br>Westwood, Maine                                                 | 04217<br>Essex International Inc.<br>Wire & Cable Div.<br>Anaheim, California                            | 06136<br>Replaced by 63743                                                                                    | 07792<br>Lerma Engineering Corp.<br>Northampton, Massachusetts                                                      |
| 02395<br>Rason Mfg. Co.<br>Brooklyn, New York                                                                           | 04221<br>Aemco, Div. of<br>Midtex Inc.<br>Mankato, Minnesota                                             | 06383<br>Panduit Corp.<br>Tinley Park, Illinois                                                               | 07910<br>Teledyne Semiconductor<br>Formerly Continental Device<br>Hawthorne, California                             |
| 02533<br>Snelgrove, C.R. Co., Ltd.<br>Don Mills, Ontario, Canada<br>M3B 1M2                                             | 04222<br>AVX Ceramics Div.<br>AVX Corp.<br>Myrtle Beach, Florida                                         | 06473<br>Bunker Ramo Corp.<br>Amphenol SAMS Div.<br>Chatsworth, California                                    | 07933<br>Use 49956<br>Raytheon Co.<br>Semiconductor Div. HQ<br>Mountain View, California                            |
| 02606<br>Fenwal Labs<br>Div. of Travenel Labs.<br>Morton Grove, Illinois                                                | 04423<br>Telonic Industries<br>Laguna Beach, California                                                  | 06555<br>Beede Electrical Instrument Co.<br>Penacook, New Hampshire                                           | 08225<br>Industro Transistor Corp.<br>Long Island City, New York                                                    |
|                                                                                                                         | 04645<br>Replaced by 75376                                                                               | 06739<br>Electron Corp.<br>Littleton, Colorado                                                                |                                                                                                                     |
|                                                                                                                         | 04713<br>Motorola Inc. Semiconductor<br>Products<br>Phoenix, Arizona                                     | 06743<br>Clevite Corp.<br>Cleveland, Ohio                                                                     |                                                                                                                     |

## Federal Supply Codes for Manufacturers (cont)

|                                                                                                                     |                                                                                              |                                                                                                                               |                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| 08261<br>Spectra Strip Corp.<br>Garden Grove, California                                                            | 11726<br>Qualidyne Corp.<br>Santa Clara, California                                          | 13606<br>Use 56289<br>Sprague Electric Co.<br>Transistor Div.<br>Concord, New Hampshire                                       | 16299<br>Corning Glass<br>Electronic Components Div.<br>Raleigh, North Carolina                      |
| 08530<br>Reliance Mica Corp.<br>Brooklyn, New York                                                                  | 12014<br>Chicago Rivet & Machine Co.<br>Bellwood, Illinois                                   | 13839<br>Replaced by 23732                                                                                                    | 16332<br>Replaced by 28478                                                                           |
| 08806<br>General Electric Co.<br>Miniature Lamp Products Dept.<br>Cleveland, Ohio                                   | 12040<br>National Semiconductor Corp.<br>Danbury, Connecticut                                | 14099<br>Semtech Corp.<br>Newbury Park, California                                                                            | 16473<br>Cambridge Scientific Ind.<br>Div. of Chemed Corporation<br>Cambridge, Maryland              |
| 08863<br>Nylomatic Corp.<br>Norrisville, Pennsylvania                                                               | 12060<br>Diodes, Inc.<br>Chatsworth, California                                              | 14140<br>Edison Electronic Div.<br>Mc Gray-Edison Co.<br>Manchester, New Hampshire                                            | 16742<br>Paramount Plastics<br>Fabricators, Inc.<br>Downey, California                               |
| 08988<br>Use 53085<br>Skottie Electronics Inc<br>Archbald, Pennsylvania                                             | 12136<br>Philadelphia Handle Co.<br>Camden, New Jersey                                       | 14193<br>Cal-R-Inc. formerly<br>California Resistor, Corp.<br>Santa Monica, California                                        | 16758<br>Delco Electronics<br>Div. of General Motors Corp.<br>Kokomo, Indiana                        |
| 09214<br>G.E. Co. Semi-Conductor<br>Products Dept.<br>Power Semi-Conductor<br>Products OPN Sec.<br>Auburn, New York | 12300<br>Potter-Brumfield Div.<br>AMF Canada LTD.<br>Guelph, Ontario, Canada                 | 14298<br>American Components, Inc.<br>an Insilco Co.<br>Conshohocken, Pennsylvania                                            | 17001<br>Replaced by 71468                                                                           |
| 09353<br>C and K Components<br>Watertown, Massachusetts                                                             | 12323<br>Presin Co., Inc.<br>Shelton, Connecticut                                            | 14655<br>Cornell-Dublier Electronics<br>Division of Federal Pacific<br>Electric Co. Govt. Control Dept.<br>Newark, New Jersey | 17069<br>Circuit Structures Lab.<br>Burbank, California                                              |
| 09423<br>Scientific Components, Inc.<br>Santa Barbara, California                                                   | 12327<br>Freeway Corp. formerly<br>Freeway Washer & Stamping Co.<br>Cleveland, Ohio          | 14752<br>Electro Cube Inc.<br>San Gabriel, California                                                                         | 17338<br>High Pressure Eng. Co., Inc.<br>Oklahoma City, Oklahoma                                     |
| 09922<br>Burndy Corp.<br>Norwalk, Connecticut                                                                       | 12443<br>The Budd Co. Polychem Products<br>Plastic Products Div.<br>Bridgeport, Pennsylvania | 14869<br>Replaced by 96853                                                                                                    | 17545<br>Atlantic Semiconductors, Inc.<br>Asbury Park, New Jersey                                    |
| 09969<br>Dale Electronics Inc.<br>Yankton, S. Dakota                                                                | 12615<br>U.S. Terminals Inc.<br>Cincinnati, Ohio                                             | 14936<br>General Instrument Corp.<br>Semi Conductor Products Group<br>Hicksville, New York                                    | 17856<br>Siliconix, Inc.<br>Santa Clara, California                                                  |
| 10059<br>Barker Engineering Corp.<br>Formerly Amerace, Amerace<br>ESNA Corp.<br>Kenilworth, New Jersey              | 12617<br>Hamlin Inc.<br>Lake Mills, Wisconsin                                                | 15636<br>Elec-Trol Inc.<br>Saugus, California                                                                                 | 17870<br>Replaced by 14140                                                                           |
| 11236<br>CTS of Berne<br>Berne, Indiana                                                                             | 12697<br>Clarostat Mfg. Co.<br>Dover, New Hampshire                                          | 15801<br>Fenwal Electronics Inc.<br>Div. of Kidde Walter and Co., Inc.<br>Framingham, Massachusetts                           | 18178<br>Vactec Inc.<br>Maryland Heights, Missouri                                                   |
| 11237<br>CTS Keene Inc.<br>Paso Robles, California                                                                  | 12749<br>James Electronics<br>Chicago, Illinois                                              | 15818<br>Teledyne Semiconductors,<br>formerly Amelco Semiconductor<br>Mountain View, California                               | 18324<br>Signetics Corp.<br>Sunnyvale, California                                                    |
| 11358<br>CBS Electronic Div.<br>Columbia Broadcasting System<br>Newburyport, Minnesota                              | 12856<br>Micrometals<br>Sierra Madre, California                                             | 15849<br>Litton Systems Inc. Useco Div.<br>formerly Useco Inc.<br>Van Nuys, California                                        | 18612<br>Vishay Resistor Products Div.<br>Vishay Intertechnology Inc.<br>Malvern, Pennsylvania       |
| 11403<br>Best Products Co.<br>Chicago, Illinois                                                                     | 12954<br>Dickson Electronics Corp.<br>Scottsdale, Arizona                                    | 15898<br>International Business<br>Machines Corp.<br>Essex Junction, Vermont                                                  | 18736<br>Voltronics Corp.<br>Hanover, New Jersey                                                     |
| 11503<br>Keystone Columbia Inc.<br>Warren, Michigan                                                                 | 12969<br>Unitrode Corp.<br>Watertown, Massachusetts                                          | 15909<br>Replaced by 14140                                                                                                    | 18927<br>GTE Sylvania Inc.<br>Precision Material Group<br>Parts Division<br>Titusville, Pennsylvania |
| 11532<br>Teledyne Relays<br>Hawthorne, California                                                                   | 13103<br>Thermalloy Co., Inc.<br>Dallas, Texas                                               | 16258<br>Space-Lok Inc.<br>Burbank, California                                                                                | 19451<br>Perine Machinery & Supply Co.<br>Seattle, Washington                                        |
| 11711<br>General Instrument Corp.<br>Rectifier Division<br>Hicksville, New York                                     | 13327<br>Solitron Devices Inc.<br>Tappan, New York                                           |                                                                                                                               | 19701<br>Electro-Midland Corp.<br>Mepco-Electra Inc.<br>Mineral Wells, Texas                         |
|                                                                                                                     | 13511<br>Amphenol Cadre Div.<br>Bunker-Ramo Corp.<br>Los Gatos, California                   |                                                                                                                               | 20584<br>Enochs Mfg. Inc.<br>Indianapolis, Indiana                                                   |

## Federal Supply Codes for Manufacturers (cont)

|                                                                                                           |                                                                                                |                                                                                                  |                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| 20891<br>Self-Organizing Systems, Inc.<br>Dallas, Texas                                                   | 28480<br>Hewlett Packard Co.<br>Corporate HQ<br>Palo Alto, California                          | 43543<br>Nytronics Inc.<br>Transformer Co. Div.<br>Geneva, New York                              | 70903<br>Belden Corp.<br>Geneva, Illinois                                                                        |
| 21604<br>Bucheys Stamping Co.<br>Columbus, Ohio                                                           | 28520<br>Heyman Mfg. Co.<br>Kenilworth, New Jersey                                             | 44655<br>Ohmite Mfg. Co.<br>Skokie, Illinois                                                     | 71002<br>Birnback Radio Co., Inc.<br>Freeport, New York                                                          |
| 21845<br>Solitron Devices Inc.<br>Transistor Division<br>Riveria Beach, Florida                           | 29083<br>Monsanto, Co., Inc.<br>Santa Clara, California                                        | 49671<br>RCA Corp.<br>New York, New York                                                         | 71400<br>Bussmann Mfg.<br>Div. of McGraw-Edison Co.<br>Saint Louis, Missouri                                     |
| 22767<br>ITT Semiconductors<br>Palo Alto, California                                                      | 29604<br>Stackpole Components Co.<br>Raleigh, North Carolina                                   | 49956<br>Raytheon Company<br>Lexington, Massachusetts                                            | 71450<br>CTS Corp.<br>Elkhart, Indiana                                                                           |
| 23050<br>Product Comp. Corp.<br>Mount Vernon, New York                                                    | 30148<br>AB Enterprise Inc.<br>Ahsoskie, North Carolina                                        | 50088<br>Mostek Corp.<br>Carrollton, Texas                                                       | 71468<br>ITT Cannon Electric Inc.<br>Santa Ana, California                                                       |
| 23732<br>Tracor Inc.<br>Rockville, Maryland                                                               | 30323<br>Illinois Tool Works, Inc.<br>Chicago, Illinois                                        | 50579<br>Litronix Inc.<br>Cupertino, California                                                  | 71482<br>Clare, C.P. & Co.<br>Chicago, Illinois                                                                  |
| 23880<br>Stanford Applied Engrng.<br>Santa Clara, California                                              | 31091<br>Optimax Inc.<br>Colmar, Pennsylvania                                                  | 51605<br>Scientific Components Inc.<br>Linden, New Jersey                                        | 71590<br>Centrelab Electronics<br>Div. of Globe Union Inc.<br>Milwaukee, Wisconsin                               |
| 23936<br>Pamotor Div., Wm. J. Purdy Co.<br>Burlingame, California                                         | 32539<br>Mura Corp.<br>Great Neck, New York                                                    | 53021<br>Sangamo Electric Co.<br>Springfield, Illinois                                           | 71707<br>Coto Coil Co., Inc.<br>Providence, Rhode Island                                                         |
| 24248<br>Replaced by 94222                                                                                | 32767<br>Griffith Plastic Corp.<br>Burlingame, California                                      | 54294<br>Cutler-Hammer Inc. formerly<br>Shallcross, A Cutter-Hammer Co.<br>Selma, North Carolina | 71744<br>Chicago Miniature Lamp Works<br>Chicago, Illinois                                                       |
| 24355<br>Analog Devices Inc.<br>Norwood, Massachusetts                                                    | 32879<br>Advanced Mechanical<br>Components<br>Northridge, California                           | 55026<br>Simpson Electric Co.<br>Div. of Am. Gage and Mach. Co.<br>Elgin, Illinois               | 71785<br>TRW Electronics Components<br>Cinch Connector Operations Div.<br>Elk Grove Village<br>Chicago, Illinois |
| 24655<br>General Radio<br>Concord, Massachusetts                                                          | 32897<br>Erie Technological Products, Inc.<br>Frequency Control Div.<br>Carlisle, Pennsylvania | 56289<br>Sprague Electric Co.<br>North Adams, Massachusetts                                      | 72005<br>Wilber B. Driver Co.<br>Newark, New Jersey                                                              |
| 24759<br>Lenox-Fugle Electronics Inc.<br>South Plainfield, New Jersey                                     | 32997<br>Bourns Inc.<br>Trimpot Products Division<br>Riverside, California                     | 58474<br>Superior Electric Co.<br>Bristol, Connecticut                                           | 72092<br>Replaced by 06980                                                                                       |
| 25088<br>Siemen Corp.<br>Isilen, New Jersey                                                               | 33173<br>General Electric Co.<br>Products Dept.<br>Owensboro, Kentucky                         | 60399<br>Torin Corp. formerly<br>Torrington Mfg. Co.<br>Torrington, Connecticut                  | 72136<br>Electro Motive Mfg. Co.<br>Williamantic, Connecticut                                                    |
| 25403<br>Amperex Electronic Corp.<br>Semiconductor &<br>Micro-Circuits Div.<br>Slatersville, Rhode Island | 34333<br>Silicon General<br>Westminster, California                                            | 63743<br>Ward Leonard Electric Co., Inc.<br>Mount Vernon, New York                               | 72259<br>Nytronics Inc.<br>Pelham Manor, New Jersey                                                              |
| 27014<br>National Semiconductor Corp.<br>Santa Clara, California                                          | 34335<br>Advanced Micro Devices<br>Sunnyvale, California                                       | 64834<br>West Mfg. Co.<br>San Francisco, California                                              | 72619<br>Dialight Div.<br>Amperex Electronic Corp.<br>Brooklyn, New York                                         |
| 27264<br>Molex Products<br>Downers Grove, Illinois                                                        | 34802<br>Electromotive Inc.<br>Kenilworth, New Jersey                                          | 65092<br>Weston Instruments Inc.<br>Newark, New Jersey                                           | 72653<br>G.C. Electronics<br>Div. of Hydrometals, Inc.<br>Brooklyn, New York                                     |
| 28213<br>Minnesota Mining & Mfg. Co.<br>Consumer Products Div.<br>St. Paul, Minnesota                     | 37942<br>P.R. Mallory & Co., Inc.<br>Indianapolis, Indiana                                     | 66150<br>Winslow Tele-Tronics Inc.<br>Eaton Town, New Jersey                                     | 72665<br>Replaced by 90303                                                                                       |
| 28425<br>Serv--Link formerly<br>Bohannon Industries<br>Fort Worth, Texas                                  | 42498<br>National Radio<br>Melrose, Massachusetts                                              | 70485<br>Atlantic India Rubber Works<br>Chicago, Illinois                                        | 72794<br>Dzus Fastener Co., Inc.<br>West Islip, New York                                                         |
| 28478<br>Deltrol Controls Div.<br>Deltrol Corporation<br>Milwaukee, Wisconsin                             |                                                                                                | 70563<br>Amperite Company<br>Union City, New Jersey                                              | 72928<br>Gulton Ind. Inc.<br>Gudeman Div.<br>Chicago, Illinois                                                   |

## Federal Supply Codes for Manufacturers (cont)

|                                                                                          |                                                                                                         |                                                                                            |                                                                                                                |
|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| 72982<br>Erie Tech. Products Inc.<br>Erie, Pennsylvania                                  | 75382<br>Kulka Electric Corp.<br>Mount Vernon, New York                                                 | 80583<br>Hammarlund Mfg. Co., Inc.<br>Red Bank, New Jersey                                 | 83594<br>Burroughs Corp.<br>Electronic Components Div.<br>Plainfield, New Jersey                               |
| 73138<br>Bechman Instrument Inc.<br>Helipot Division<br>Fullerton, California            | 75915<br>Littlefuse Inc.<br>Des Plaines, Illinois                                                       | 80640<br>Arnold Stevens, Inc.<br>South Boston, Massachusetts                               | 83740<br>Union Carbide Corp.<br>Battery Products Div.<br>formerly Consumer Products Div.<br>New York, New York |
| 73293<br>Hughes Aircraft Co.<br>Electron Dynamics Div.<br>Torrance, California           | 76854<br>Oak Industries Inc.<br>Switch Div.<br>Crystal Lake, Illinois                                   | 81073<br>Grayhill, Inc.<br>La Grange, Illinois                                             | 84171<br>Arco Electronics<br>Great Neck, New York                                                              |
| 73445<br>Amperex Electronic Corp.<br>Hicksville, New York                                | 77342<br>AMF Inc.<br>Potter & Brumfield Div.<br>Princeton, Indiana                                      | 81312<br>Winchester Electronics<br>Div. of Litton Industries Inc.<br>Oakville, Connecticut | 84411<br>TRW Electronic Components<br>TRW Capacitors<br>Ogallala, Nebraska                                     |
| 73559<br>Carling Electric Inc.<br>West Hartford, Connecticut                             | 77638<br>General Instrument Corp.<br>Rectifier Division<br>Brooklyn, New York                           | 81483<br>Therm-O-Disc Inc.<br>Mansfield, Ohio                                              | 84613<br>Fuse Indicator Corp.<br>Rockville, Maryland                                                           |
| 73586<br>Circle F Industries<br>Trenton, New Jersey                                      | 77969<br>Rubbercraft Corp. of CA. LTD.<br>Torrance, California                                          | 81483<br>International Rectifier Corp.<br>Los Angeles, California                          | 84682<br>Essex International Inc.<br>Industrial Wire Div.<br>Peabody, Massachusetts                            |
| 73734<br>Federal Screw Products, Inc.<br>Chicago, Illinois                               | 78189<br>Shakeproof<br>Div. of Illinois Tool Works Inc.<br>Elgin, Illinois                              | 81590<br>Korrry Mfg. Co.<br>Seattle, Washington                                            | 86577<br>Precision Metal Products<br>of Malden Inc.<br>Stoneham, Massachusetts                                 |
| 73743<br>Fischer Special Mfg. Co.<br>Cincinnati, Ohio                                    | 78277<br>Sigma Instruments, Inc.<br>South Braintree, Massachusetts                                      | 81741<br>Chicago Lock Co.<br>Chicago, Illinois                                             | 86684<br>Radio Corp. of America<br>Electronic Components Div.<br>Harrison, New Jersey                          |
| 73899<br>JFD Electronics Co.<br>Components Corp.<br>Brooklyn, New York                   | 78488<br>Stackpole Carbon Co.<br>Saint Marys, Pennsylvania                                              | 82305<br>Palmer Electronics Corp.<br>South Gate, California                                | 86928<br>Seastrom Mfg. Co., Inc.<br>Glendale, California                                                       |
| 73949<br>Guardian Electric Mfg. Co.<br>Chicago, Illinois                                 | 78553<br>Eaton Corp. Engineered<br>Fastener Div.<br>Tinnerman Plant<br>Cleveland, Ohio                  | 82389<br>Switchcraft Inc.<br>Chicago, Illinois                                             | 87034<br>Illuminated Products Inc.<br>Subsidiary of Oak Industries Inc.<br>Anaheim, California                 |
| 74199<br>Quan Nichols Co.<br>Chicago, Illinois                                           | 79136<br>Waldes Kohinoor Inc.<br>Long Island City, New York                                             | 82415<br>North American Phillips<br>Controls Corp.<br>Frederick, Maryland                  | 88219<br>Gould Inc.<br>Industrial Div.<br>Trenton, New Jersey                                                  |
| 74217<br>Radio Switch Corp.<br>Marlboro, New Jersey                                      | 79497<br>Western Rubber Company<br>Goshen, Indiana                                                      | 82872<br>Roanwell Corp.<br>New York, New York                                              | 88245<br>Litton Systems Inc.<br>Usco Div.<br>Van Nuys, California                                              |
| 74276<br>Signalite Div.<br>General Instrument Corp.<br>Neptune, New Jersey               | 79963<br>Zierick Mfg. Corp.<br>Mt. Kisko, New York                                                      | 82877<br>Rotron Inc.<br>Woodstock, New York                                                | 88419<br>Cornell-Dubilier Electronic Div.<br>Federal Pacific Co.<br>Fuquay-Varian, North Carolina              |
| 74306<br>Piezo Crystal Co.<br>Carlisle, Pennsylvania                                     | 80031<br>Electro-Midland Corp.<br>Mepco Div.<br>A North American Phillips Co.<br>Norristown, New Jersey | 82879<br>ITT Royal Electric Div.<br>Pawtucket, Rhode Island                                | 88486<br>Plastic Wire & Cable<br>Jewitt City, Connecticut                                                      |
| 74542<br>Hoyt Elect. Instr. Works<br>Penacook, New Hampshire                             | 80145<br>LFE Corp., Process Control Div.<br>formerly API Instrument Co.<br>Chesterland, Ohio            | 83003<br>Varo Inc.<br>Garland, Texas                                                       | 88690<br>Replaced by 04217                                                                                     |
| 74970<br>Johnson E.F., Co.<br>Waseca, Minnesota                                          | 80183<br>Use 56289<br>Sprague Products<br>North Adams, Massachusetts                                    | 83058<br>The Carr Co., United Can Div.<br>of TRW<br>Cambridge, Massachusetts               | 89536<br>John Fluke Mfg. Co., Inc.<br>Seattle, Washington                                                      |
| 75042<br>TRW Electronics Components<br>IRC Fixed Resistors<br>Philadelphia, Pennsylvania | 80294<br>Bourns Inc., Instrument Div.<br>Riverside, California                                          | 83298<br>Bendix Corp.<br>Electric Power Div.<br>Eatontown, New Jersey                      | 89730<br>G.E. Co., Newark Lamp Works<br>Newark, New Jersey                                                     |
| 75376<br>Kurz-Kasch Inc.<br>Dayton, Ohio                                                 |                                                                                                         | 83330<br>Herman H. Smith, Inc.<br>Brooklyn, New York                                       |                                                                                                                |
| 75378<br>CTS Knights Inc.<br>Sandwich, Illinois                                          |                                                                                                         | 83478<br>Rubbercraft Corp.<br>of America, Inc.<br>West Haven, Connecticut                  |                                                                                                                |

## Federal Supply Codes for Manufacturers (cont)

|                                                                                           |                                                                                             |                                                                                                                                   |                                                                                                                                     |
|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| 90201<br>Mallory Capacitor Co.<br>Div. of P.R. Mallory Co., Inc.<br>Indianapolis, Indiana | 91836<br>King's Electronics Co., Inc.<br>Tuckahoe, New York                                 | 95354<br>Methode Mfg. Corp.<br>Rolling Meadows, Illinois                                                                          | 98291<br>Sealectro Corp.<br>Mamaroneck, New York                                                                                    |
| 90211<br>Use 56365<br>Square D Co.<br>Chicago, Illinois                                   | 91929<br>Honeywell Inc.<br>Micro Switch Div.<br>Freeport, Illinois                          | 95712<br>Bendix Corp.<br>Electrical Components Div.<br>Microwave Devices Plant<br>Franklin, Indiana                               | 98388<br>Royal Industries<br>Products Div.<br>San Diego, California                                                                 |
| 90215<br>Best Stamp & Mfg. Co.<br>Kansas City, Missouri                                   | 91934<br>Miller Electric Co., Inc.<br>Div. of Aunet<br>Woonsocket, Rhode Island             | 95987<br>Weckesser Co. Inc.<br>Chicago, Illinois                                                                                  | 98743<br>Replaced by 12749                                                                                                          |
| 90303<br>Mallory Battery Co.<br>Div. of Mallory Co., Inc.<br>Tarrytown, New York          | 92194<br>Alpha Wire Corp.<br>Elizabeth, New Jersey                                          | 96733<br>San Fernando Electric Mfg. Co.<br>San Fernando, California                                                               | 98925<br>Replaced by 14433                                                                                                          |
| 91094<br>Essex International Inc.<br>Suglex/WP Div.<br>Newmarket, New Hampshire           | 93332<br>Sylvania Electric Products<br>Semiconductor Products Div.<br>Woburn, Massachusetts | 96853<br>Gulton Industries Inc.<br>Measurement and Controls Div.<br>formerly Rustrak Instruments Co.<br>Manchester, New Hampshire | 99120<br>Plastic Capacitors, Inc.<br>Chicago, Illinois                                                                              |
| 91293<br>Johanson Mfg. Co.<br>Boonton, New Jersey                                         | 94145<br>Replaced by 49956                                                                  | 96881<br>Thomson Industries, Inc.<br>Manhasset, New York                                                                          | 99217<br>Bell Industries Elect.<br>Comp. Div.<br>formerly Southern Elect. Div.<br>Burbank, California                               |
| 91407<br>Replaced by 58474                                                                | 94154<br>Use 94988<br>Wagner Electric Corp.<br>Tung-Sol Div.<br>Newark, New Jersey          | 97540<br>Master Mobile Mounts, Div. of<br>Whitehall Electronics Corp.<br>Ft. Meyers, Florida                                      | 99392<br>STM<br>Oakland, California                                                                                                 |
| 91502<br>Associated Machine<br>Santa Clara, California                                    | 94222<br>Southco Inc. formerly<br>South Chester Corp.<br>Lester, Pennsylvania               | 97913<br>Industrial Electronic<br>Hardware Corp.<br>New York, New York                                                            | 99515<br>ITT Jennings Monrovia Plant<br>Div. of ITT Jennings formerly<br>Marshall Industries Capacitor Div.<br>Monrovia, California |
| 91506<br>Augat Inc.<br>Attleboro, Massachusetts                                           | 95146<br>Alco Electronic Products Inc.<br>Lawrence, Massachusetts                           | 97945<br>Penwalt Corp.<br>SS White Industrial Products Div.<br>Piscataway, New Jersey                                             | 99779<br>Use 29587<br>Bunker-Ramo Corp.<br>Barnes Div.<br>Landsdowne, Pennsylvania                                                  |
| 91637<br>Dale Electronics Inc.<br>Columbus, Nebraska                                      | 95263<br>Leecraft Mfg. Co.<br>Long Island City, New York                                    | 97966<br>Replaced by 11358                                                                                                        | 99800<br>American Precision Industries Inc.<br>Delevan Division<br>East Aurora, New York                                            |
| 91662<br>Elco Corp.<br>Willow Grove, Pennsylvania                                         | 95264<br>Replaced by 98278                                                                  | 98094<br>Replaced by 49956                                                                                                        | 99942<br>Centrelab Semiconductor<br>Centrelab Electronics Div. of<br>Globe-Union Inc.<br>El Monte, California                       |
| 91737<br>Use 71468<br>Gremar Mfg. Co., Inc.<br>ITT Cannon/Gremar<br>Santa Ana, California | 95275<br>Vitramon Inc.<br>Bridgeport, Connecticut                                           | 98159<br>Rubber-Teck, Inc.<br>Gardena, California                                                                                 | Toyo Electronics<br>(R-Ohm Corp.)<br>Irvine, California                                                                             |
| 91802<br>Industrial Devices, Inc.<br>Edgewater, New Jersey                                | 95303<br>RCA Corp.<br>Receiving Tube Div.<br>Cincinnati, Ohio                               | 98278<br>Malco A Microdot Co., Inc.<br>Connector & Cable Div.<br>Pasadena, California                                             | National Connector<br>Minneapolis, Minnesota                                                                                        |
| 91833<br>Keystone Electronics Corp.<br>New York, New York                                 | 95348<br>Gordo's Corp.<br>Bloomfield, New Jersey                                            |                                                                                                                                   |                                                                                                                                     |



## Appendix 7A

# Manual Change Information

### INTRODUCTION

This appendix contains information necessary to backdate the manual to conform with earlier pcb configurations. To identify the configuration of the pcb's used in your instrument, refer to the revision letter (marked in ink) on the component side of each pcb assembly. Table 7A-1 defines the assembly revision levels documented in this manual.

### NEWER INSTRUMENTS

As changes and improvements are made to the

instrument, they are identified by incrementing the revision letter marked on the affected pcb assembly. These changes are documented on a supplemental change/errata sheet which, when applicable, is inserted at the front of the manual.

### OLDER INSTRUMENTS

To backdate this manual to conform with earlier assembly revision levels, perform the changes indicated in Table 7A-1.

**Table 7A-1. Manual Status and Backdating Information**

| Ref<br>Or<br>Option<br>No.                                                                                                                                      | Assembly<br>Name                | Fluke<br>Part<br>No. | * To adapt manual to earlier rev configurations perform changes<br>in descending order (by no.), ending with change under desired rev. letter |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--|--|
|                                                                                                                                                                 |                                 |                      | —                                                                                                                                             | A | B | C | D | E | F | G | H | J | K | L | M | N | P |  |  |  |
| A1                                                                                                                                                              | Display PCB Assembly            | 516625               | 3                                                                                                                                             | 2 | 1 | X |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| A2                                                                                                                                                              | Digital Controller PCB Assembly | 492828               |                                                                                                                                               |   | 4 | X |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| A3                                                                                                                                                              | Analog PCB Assembly             | 496836               |                                                                                                                                               |   | 7 | 6 | 5 | X |   |   |   |   |   |   |   |   |   |  |  |  |
| A3A1                                                                                                                                                            | Reference Module (Horizontal)   | 527994               | X                                                                                                                                             |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| A3A1                                                                                                                                                            | Reference Module (Vertical)     | 530626               | X                                                                                                                                             |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| A4                                                                                                                                                              | Transformer Assembly            | 496869               |                                                                                                                                               |   |   |   | X |   |   |   |   |   |   |   |   |   |   |  |  |  |
|                                                                                                                                                                 |                                 |                      |                                                                                                                                               |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| * X = The PCB revision levels documented in this manual.<br>● = These revision letters were never used in the instrument.<br>— = No revision letter on the PCB. |                                 |                      |                                                                                                                                               |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |

Item changes in the parts lists are in the format below. Refer to Section 6 for an explanation of the headings in the format.

REF DES/ DESCRIPTION/ FLUKE STOCK NO/ MFG SPLY CODE/ MFG PART NO/ QTY

#### Change 1 (ECO #13461)

A1 Rev B did not include the following:

MP4/ SPACER/ 434399/ 89536/ 434399/ 1

#### Change 2 (ECO #13478)

A1 Rev A Resistor R2 was as listed:

R2/ RES, DEP CAR, 200  $\pm 5\%$ , 1/4W/ 441451/ 80031/ CR251-4-5P200E/ 1

#### Change 3 (ECO #13216)

A1 Rev - had the following items as listed:

S1/ BUTTON, LT PUTTY GREY/ 401307/ 89536/ 401307/ 17

S4/ SW, MOMENTARY LIGHTED, PUTTY/ 507335/ 89536/ 507335/ 5

S11/ SW, MOMENTARY LIGHTED, PUTTY/ 507335/ 89536/ 507335/ REF

S12/ BUTTON, LT PUTTY GREY/ 401307/ 89536/ 401307/ REF

S13/ BUTTON, LT PUTTY GREY/ 401307/ 89536/ 401307/ REF

#### Change 4 (ECO #13236)

A2 Rev B did not include the following:

C12/ CAP, TA, 1UF20%, 15V/ 423012/ 56289/ 196D226X0015KA1/ 2

CR3/ DIODE, SI, HI-SPEED SWITCHING/ 203323/ 07910/ 1N4448/ REF

L1/ CHOKE, 6 TURN/ 320911/ 89536/ 320911/ 1

R27/ RES, DEP CAR, 1.2K5%, 1/4W/ 441378/ 80031/ CR251-4-5P1K2/ 1

A2 Rev B did include:

R20/ RES, DEP CAR, 1K5%, 1/4W/ 343426/ 80031/ CR251-4-5P1K/ REF

R22/ RES, DEP CAR, 1K5%, 1/4W/ 343426/ 80031/ CR251-4-5P1K/ REF

A2 Rev B had the following items as listed:

C1/ CAP, TA, 1UF $\pm 20\%$ , 35V/ 161919/ 56289/ 196D105X0020JA1/ 5

C20/ CAP, TA, 1UF $\pm 20\%$ , 35V/ 161919/ 56289/ 196D105X0020JA1/ REF

C204/ CAP, TA, 22UF $\pm 20\%$ , 15V/ 423012/ 56289/ 196D226X0015KA1/ 1

CR1/ DIODE, SI, HI-SPEED SWITCHING/ 203323/ 07910/ 1N4448/ 2

H3/ SCREW, PHP, 10/32 X 3/8/ 114314/ 73734/ 19084/ 2

R1/ RES, DEP CAR, 1K $\pm 5\%$ , 1/4W/ 343426/ 80031/ CR251-4-5P1K/ 9

R14/ RES, DEP CAR, 10K $\pm 5\%$ , 1/4W/ 348839/ 80031/ CR251-4-5P10K/ 6

R16/ RES, DEP CAR, 10K $\pm 5\%$ , 1/4W/ 348839/ 80031/ CR251-4-5P10K/ REF

U1/ IC, TTL, DUAL "D" TYPE CLR & PS/ 393124/ 01295/ SN74LS74N/ 4

U20/ IC, TTL, DUAL "D" TYPE CLR & PS/ 393124/ 01295/ SN74LS74N/ REF

U35/ IC, C-MOS, 74C, DUAL "D" TYPE F/F/ 418830/ 12040/ MM74C74/ 1

#### Change 5 (ECO #13504)

A3 REV D did not include the following:

R273/ RES, COMP, 100M $\pm 10\%$ , 1/2W/ 190520/ 01121/ EB1071/ 2

R274/ RES, COMP, 100M $\pm 10\%$ , 1/2W/ 190520/ 01121/ EB1071/ REF

#### Change 6 (ECO #13275)

A3 REV C did not include the following:

C244/ CAP, CER, 150PF $\pm 5\%$ , 100V/ 512988/ 89536/ 512988/ 1

#### Change 7 (ECO #13226)

A3 REV B did not include the following:

RN402/ RESISTOR NETWORK ASSY/ 412916/ 89536/ 412916/ 1

A3A1 Reference Module (Horizontal), PN #527994, was installed in lieu of A3A1 Reference Module (Vertical), PN #530626.

Items Q239, Q240, R267, R268, R269, and R270 were installed on a small vertical PCB (8520A-4050) in lieu of CR216 and CR217. On revisions C and subsequent these items are installed directly on the A3 PCB.

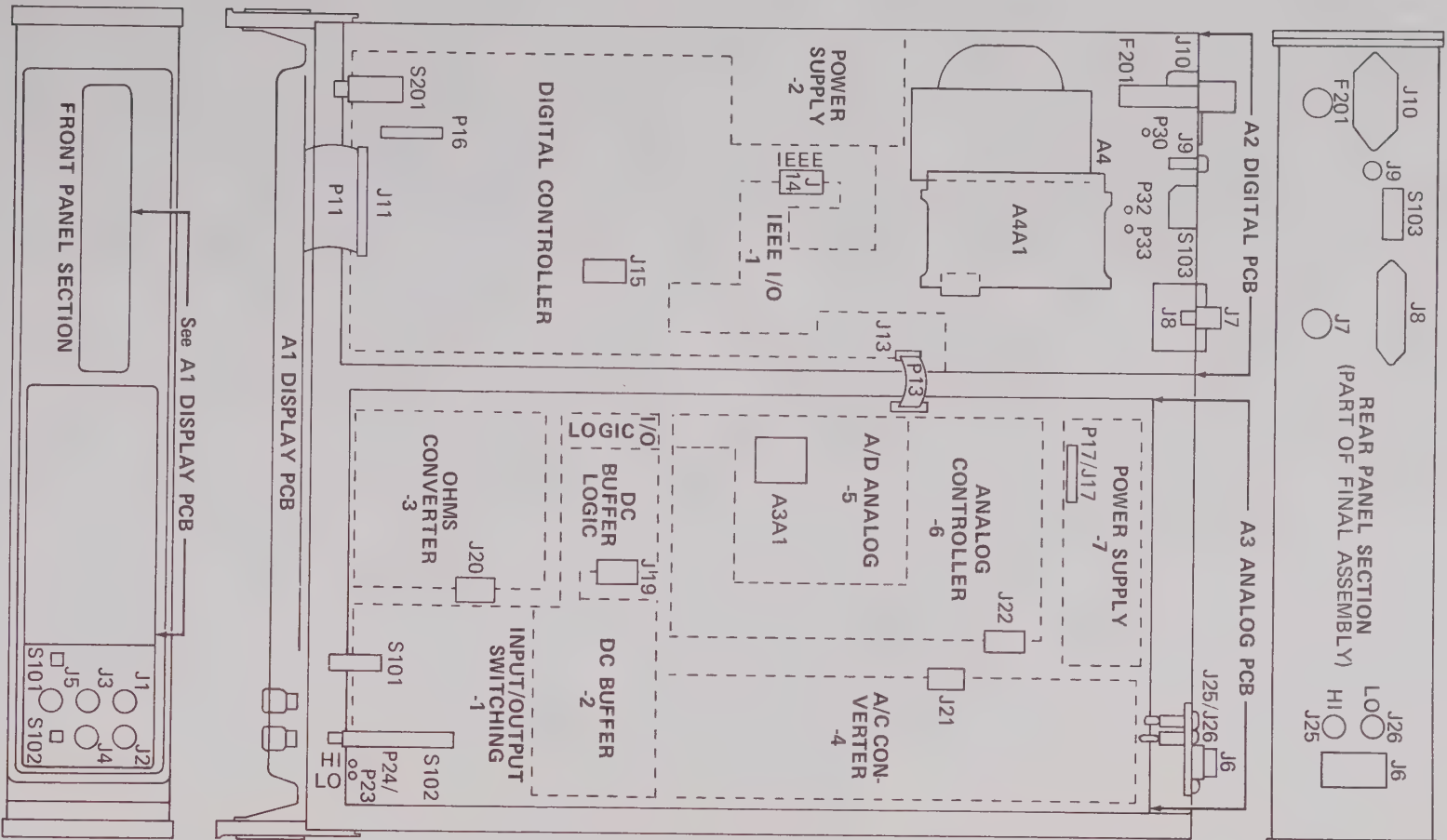
## Section 8

# Schematic Diagrams

### TABLE OF CONTENTS

| FIGURE | TITLE                    | DRAWING NO. | PAGE |
|--------|--------------------------|-------------|------|
| 8-1.   | Assembly Placement ..... | 8520A-1303  | 8-3  |
| 8-2.   | Power Supply .....       | 8520A-1023  | 8-4  |
| 8-3.   | Display .....            | 8520A-1011  | 8-6  |
| 8-4.   | Digital Controller ..... | 8520A-1021  | 8-8  |
| 8-5.   | IEEE-488 Interface ..... | 8520A-1022  | 8-14 |
| 8-6.   | Input/Output SW .....    | 8520A-1031  | 8-16 |
| 8-7.   | DC Buffer .....          | 8520A-1032  | 8-18 |
| 8-8.   | Ohms Converter .....     | 8520A-1033  | 8-20 |
| 8-9.   | A/D Converter .....      | 8520A-1034  | 8-22 |
| 8-10.  | A/D Analog .....         | 8520A-1035  | 8-24 |
| 8-11.  | Analog Controller .....  | 8520A-1036  | 8-26 |
| 8-12.  | Reference Module .....   | 8520A-1045  | 8-30 |

**NOTES**



8520A-1303

Figure 8-1. Assembly Placement

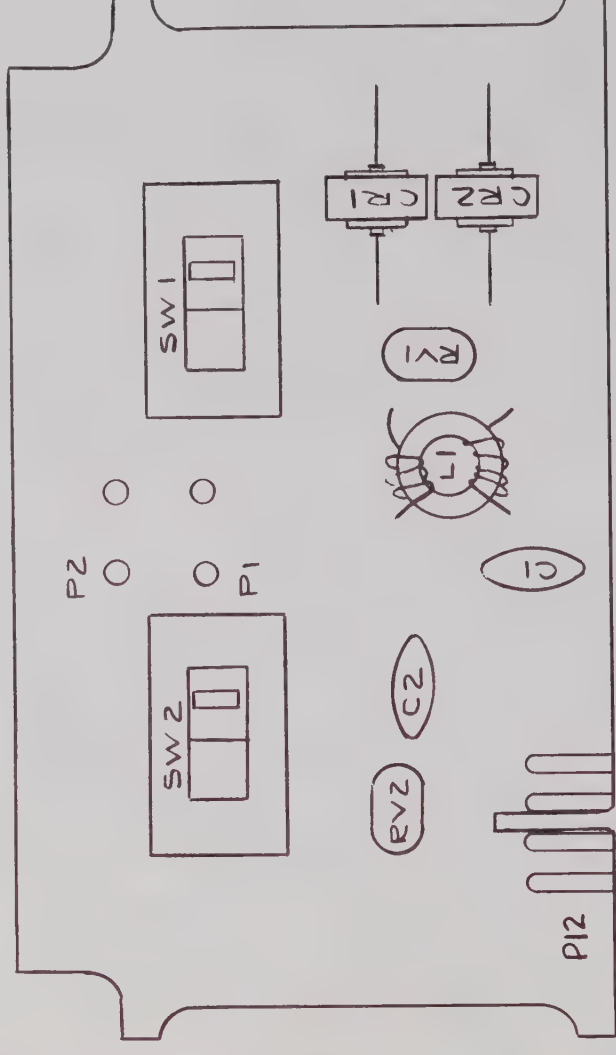
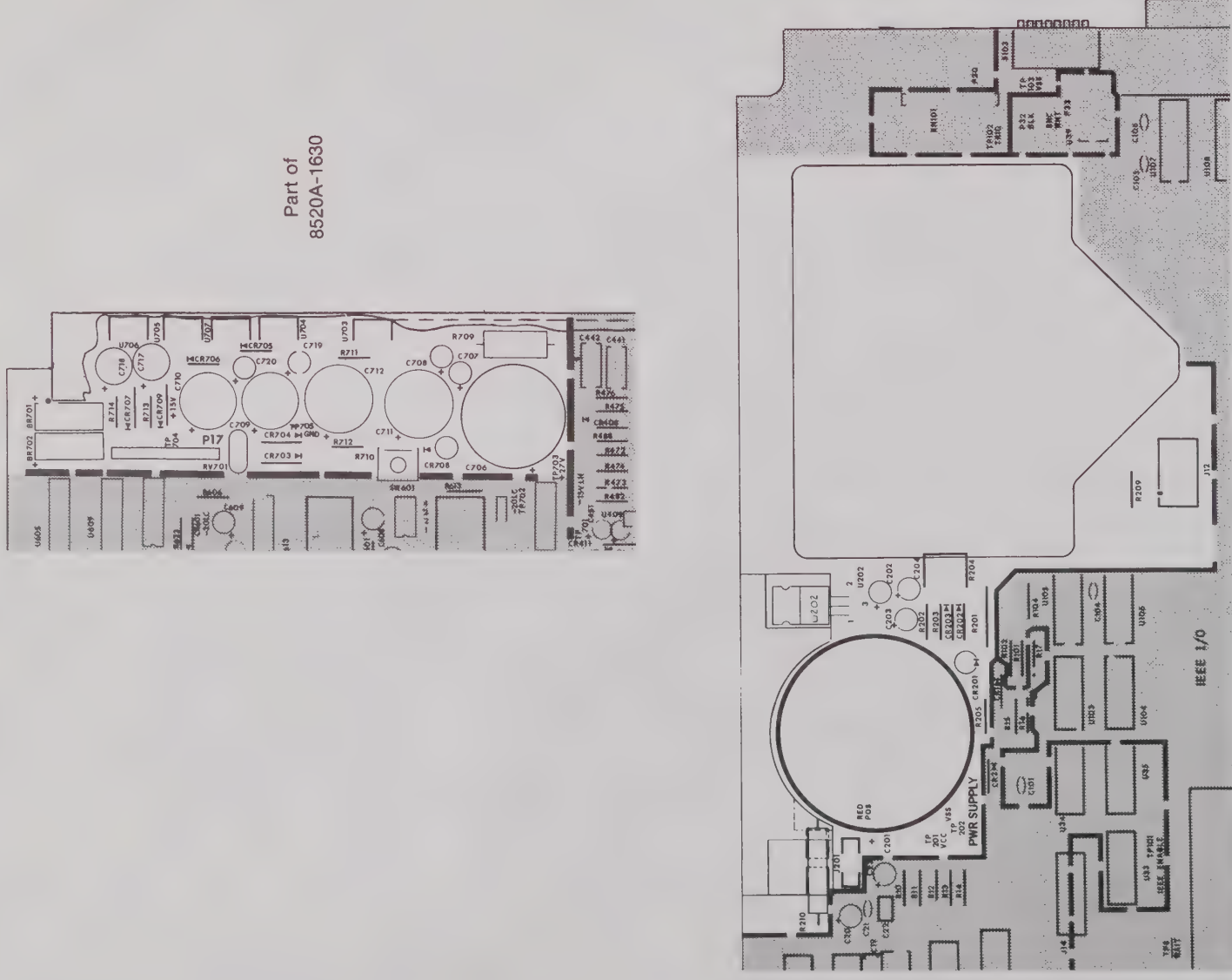
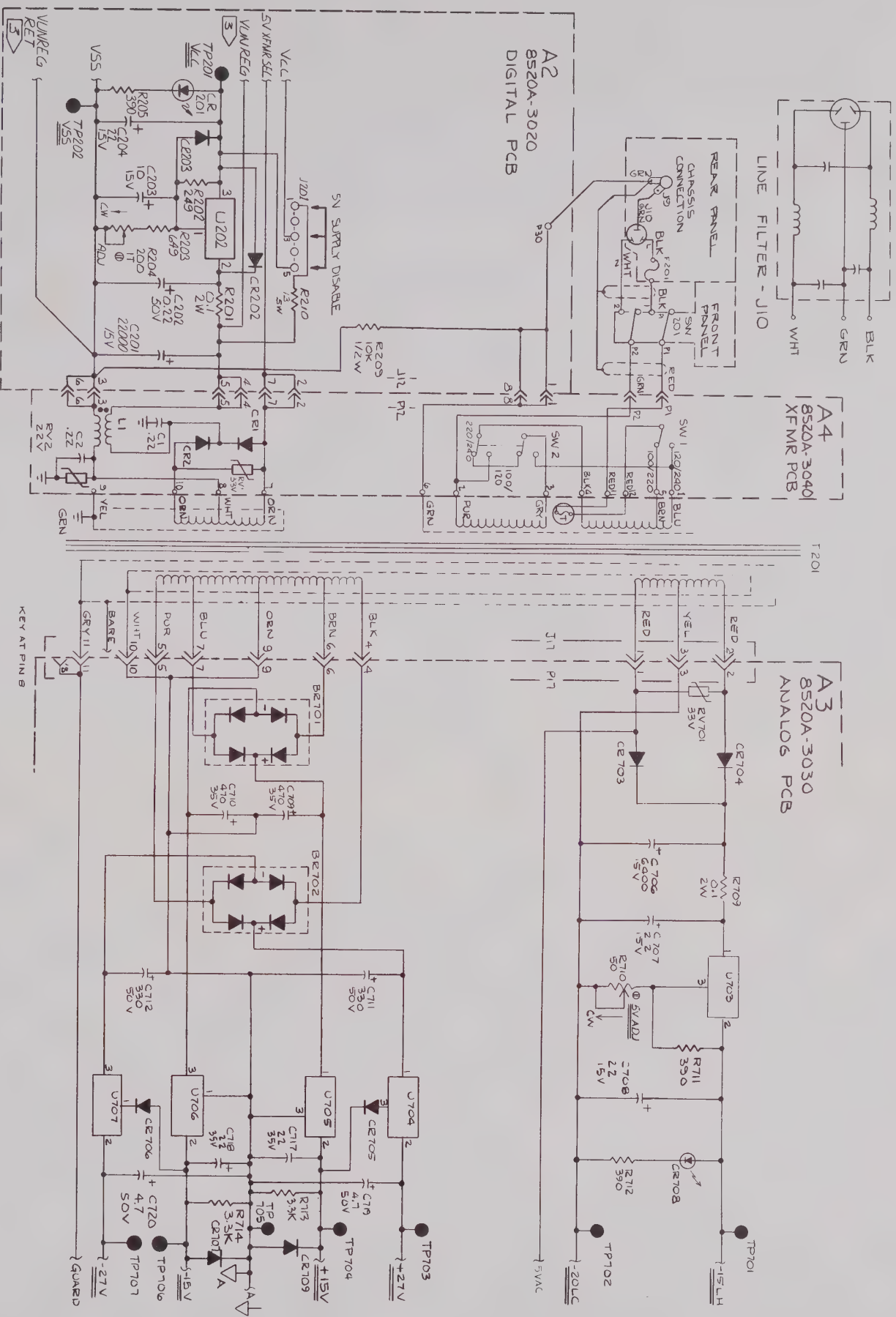


**Figure 8-2. Power Supply**



NOTES: UNLESS OTHERWISE SPECIFIED:  
1. ALL RESISTANCE VALUES IN OHMS.  
2. ALL CAPACITANCE VALUES IN MICRO-FARADS.  
3 ONLY TO FRONT PANEL.

| ANALOG CONTROLLER |   |   |    |
|-------------------|---|---|----|
| A.C. CONVERTER    |   |   |    |
| OHMS              |   |   |    |
| DC BUFFER/105W    |   |   |    |
| +27V              | 1 | 7 | 8  |
| +15V              | 6 | 6 | 9  |
| -15V              | 5 | 5 | 10 |
| -15LH             | 4 | 4 | 11 |
| -20LC             | 3 | 3 | 12 |
| -27V              | 2 | 2 | 13 |
| VOLTAGE INPUT NO. |   |   |    |

Figure 8-2. Power Supply (cont)



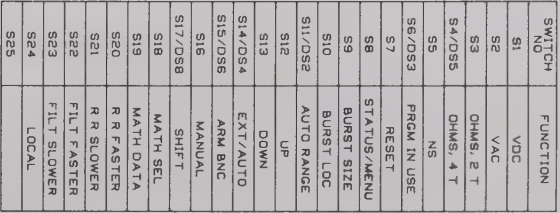


**Figure 8-3. Display (cont)**

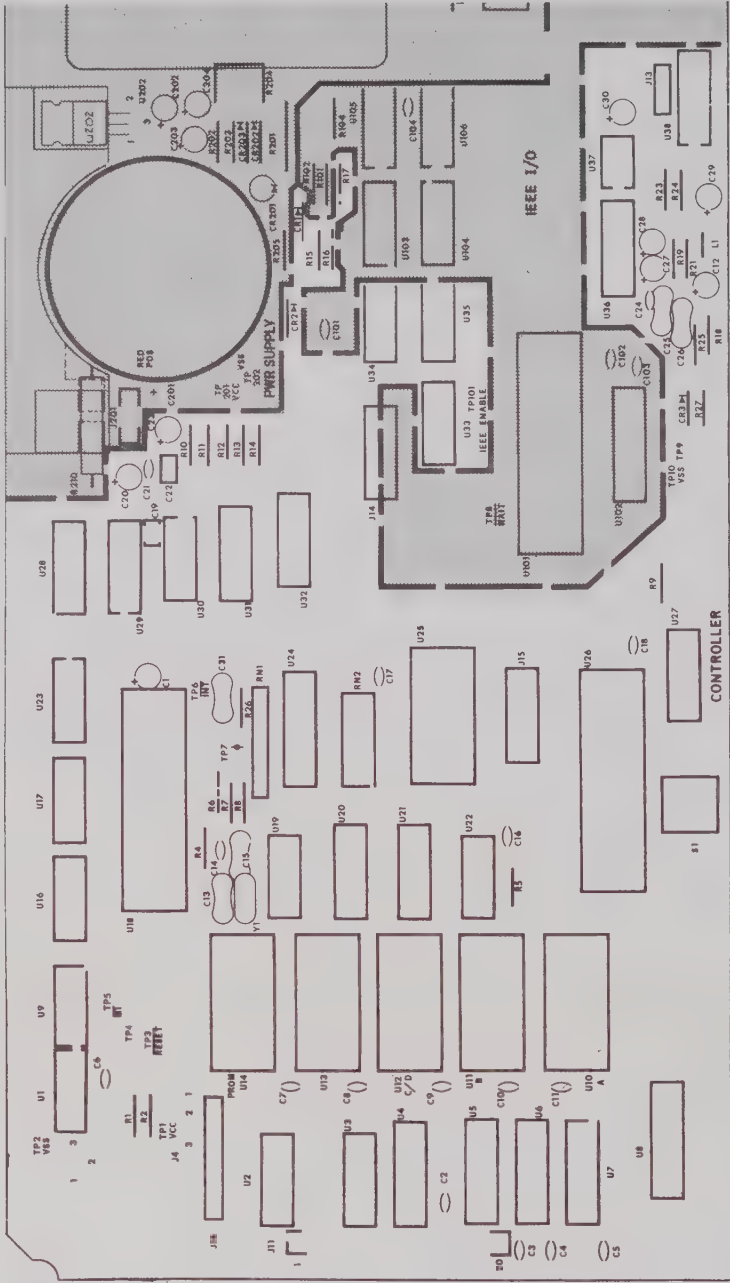


Figure 8-4. Digital Controller



**Figure 8-4. Digital Controller (cont)**

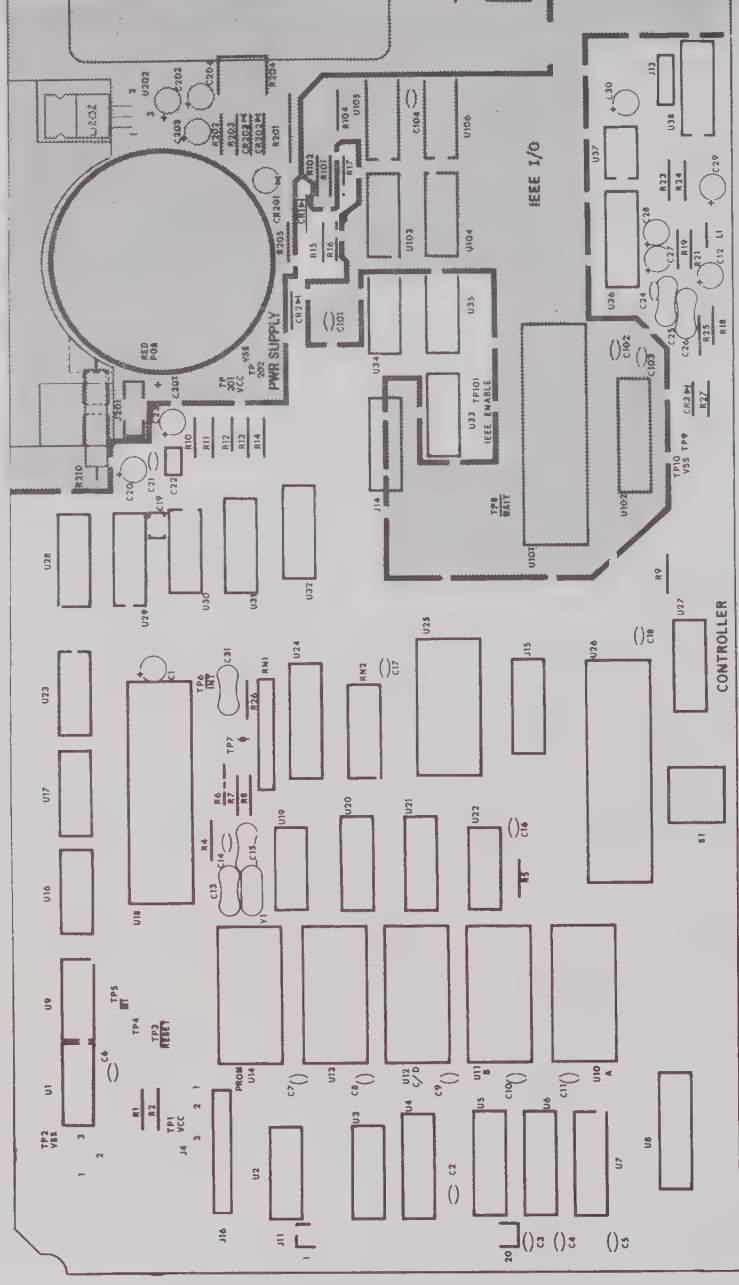


Figure 8-4. Digital Controller (cont)

8520A-1021(2 of 3)

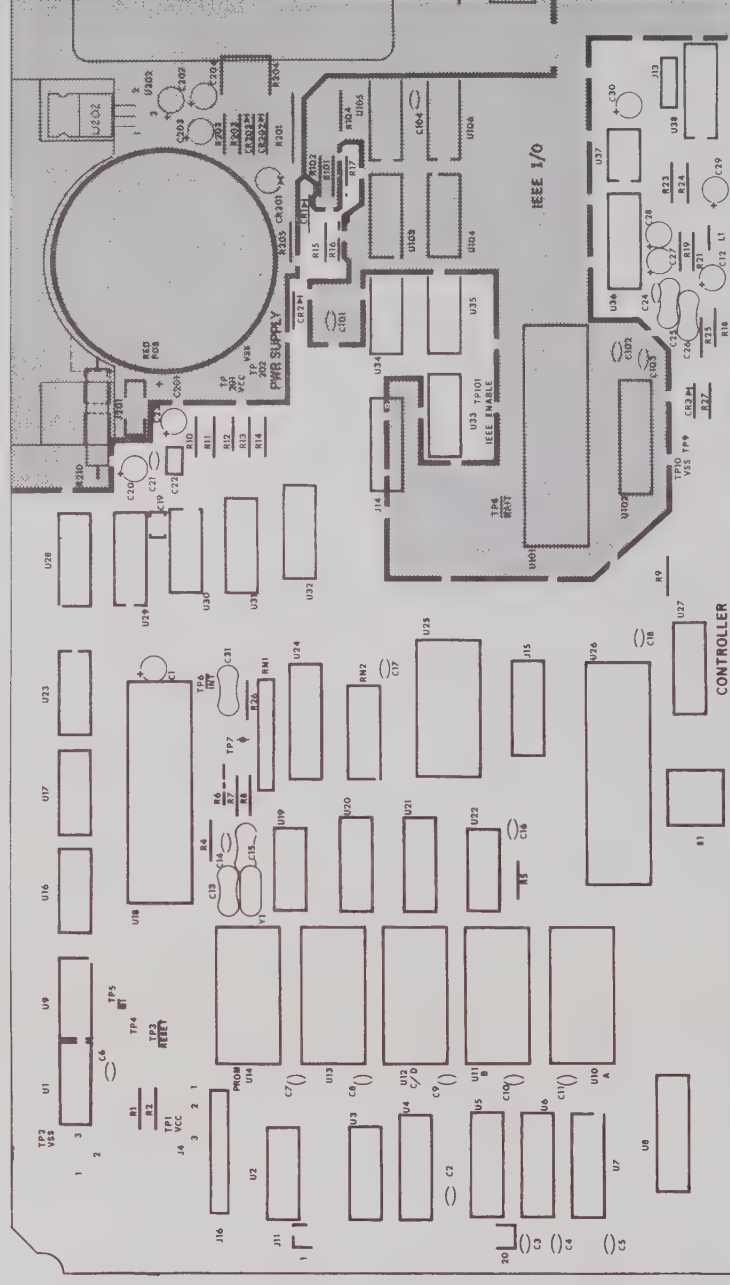


Figure 8-4. Digital Controller (cont)

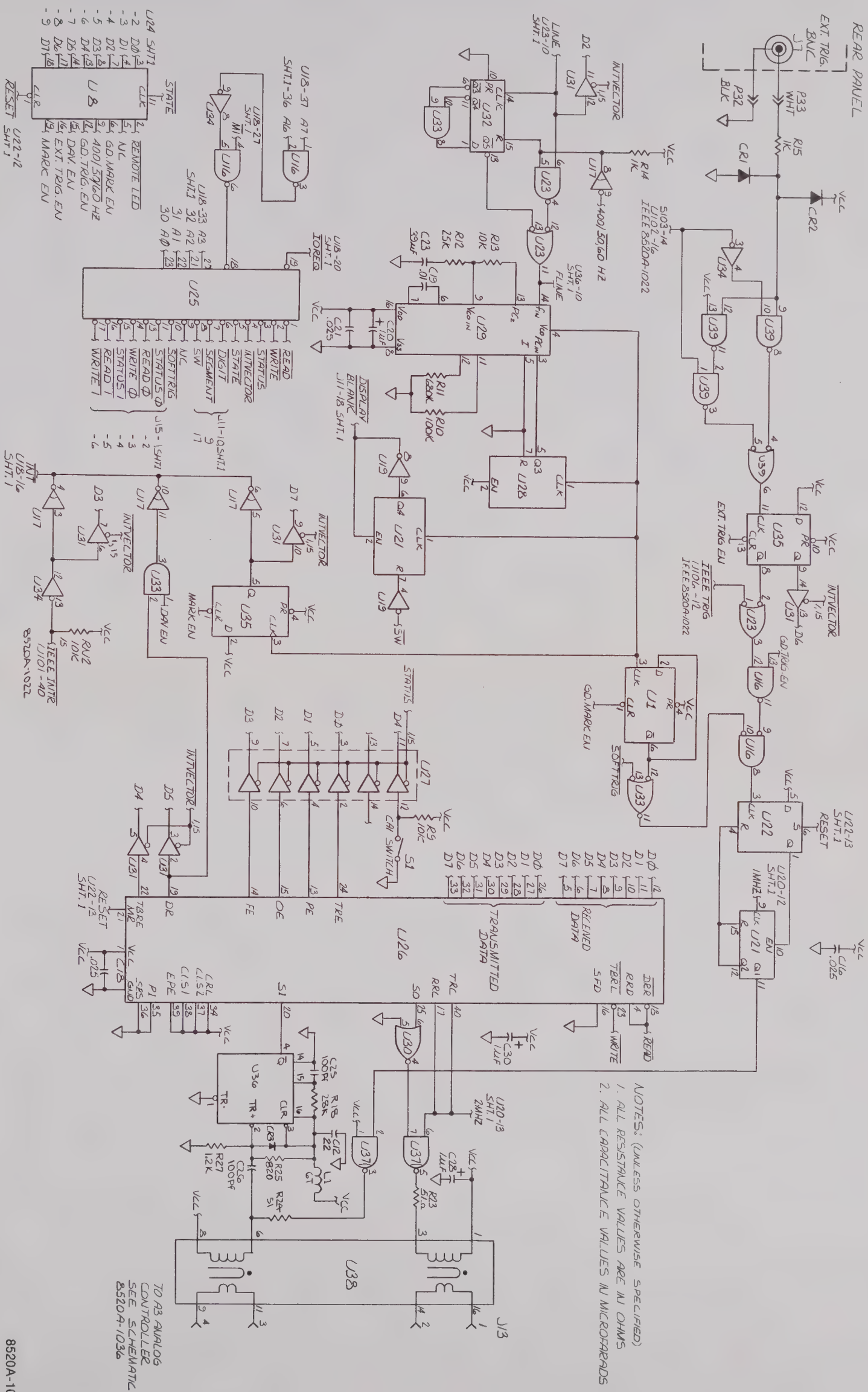


Figure 8-4. Digital Controller (cont)

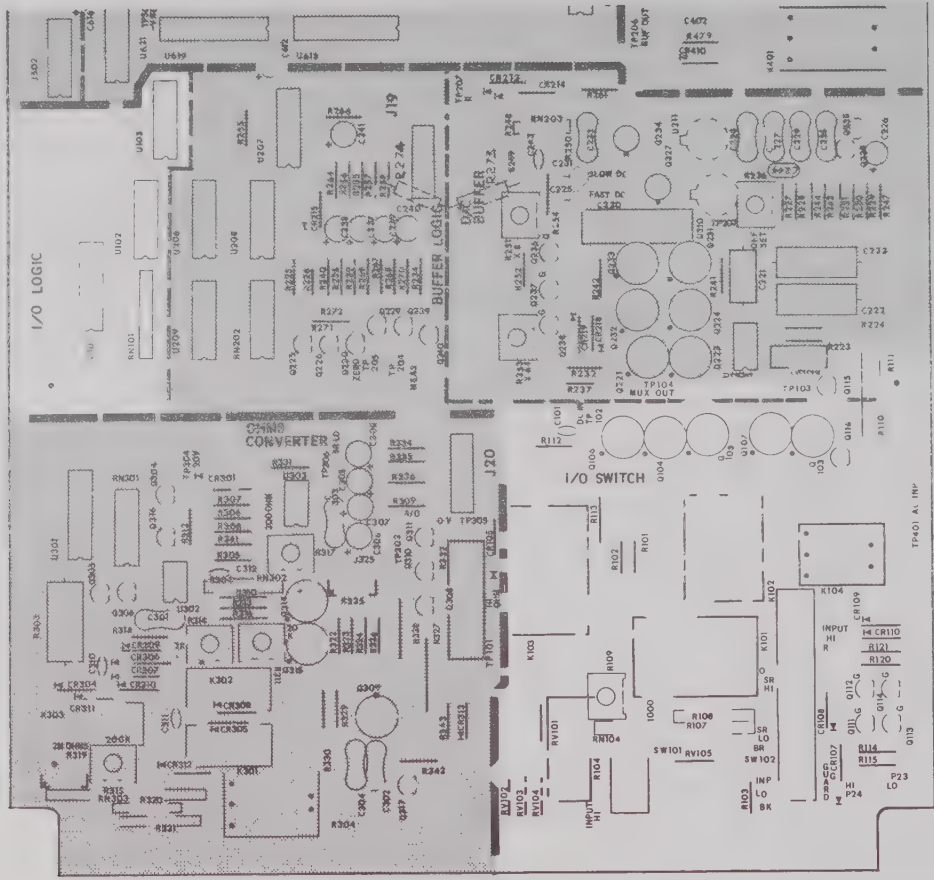


Figure 8-6. Input/Output SW

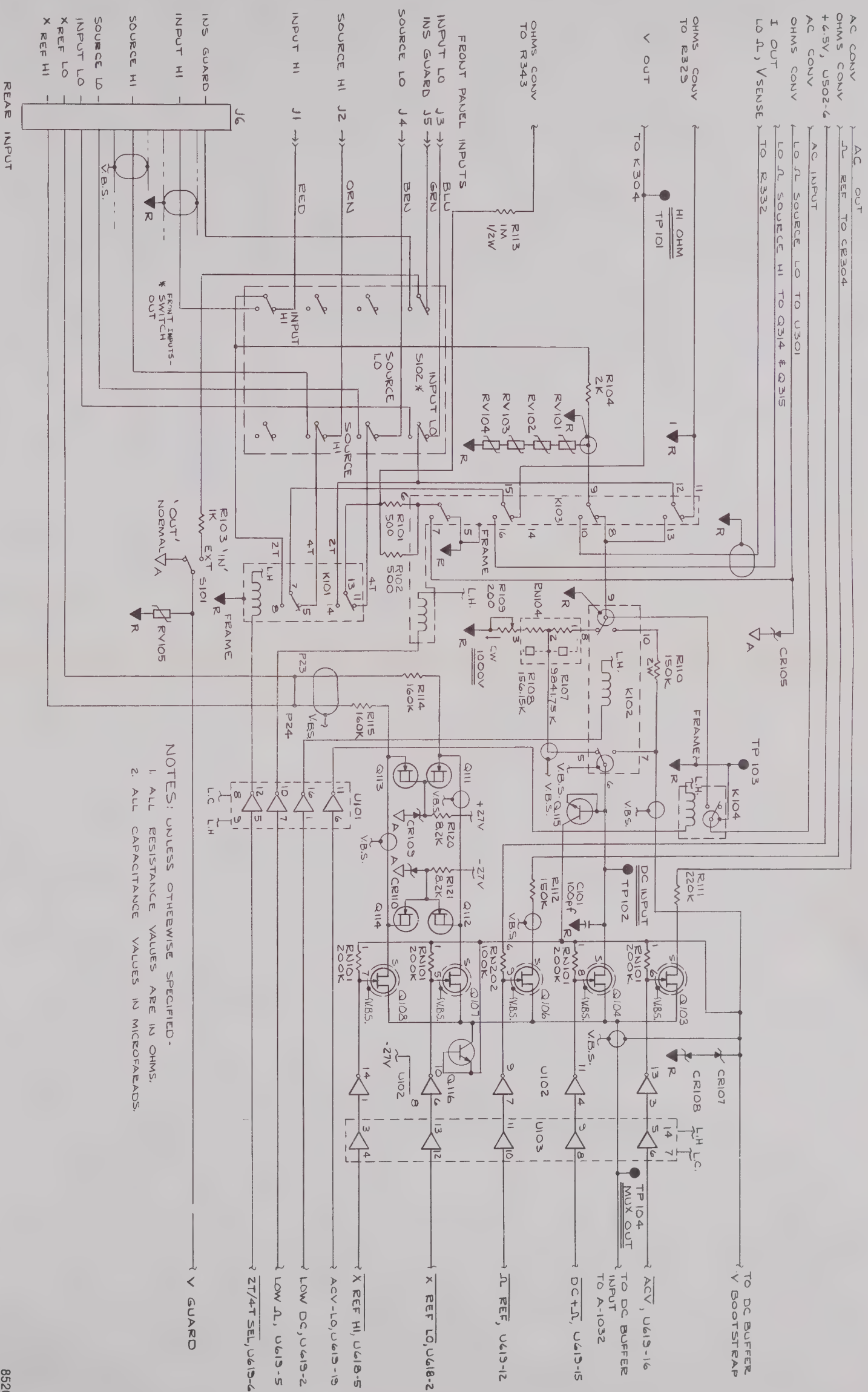


**Figure 8-6. Input/Output SW (cont)**

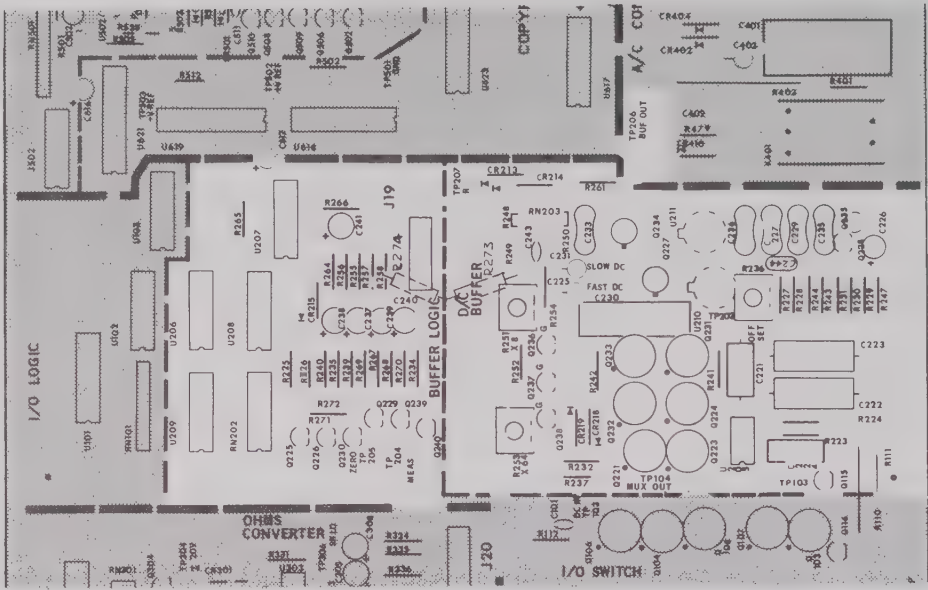


Figure 8-7. DC Buffer



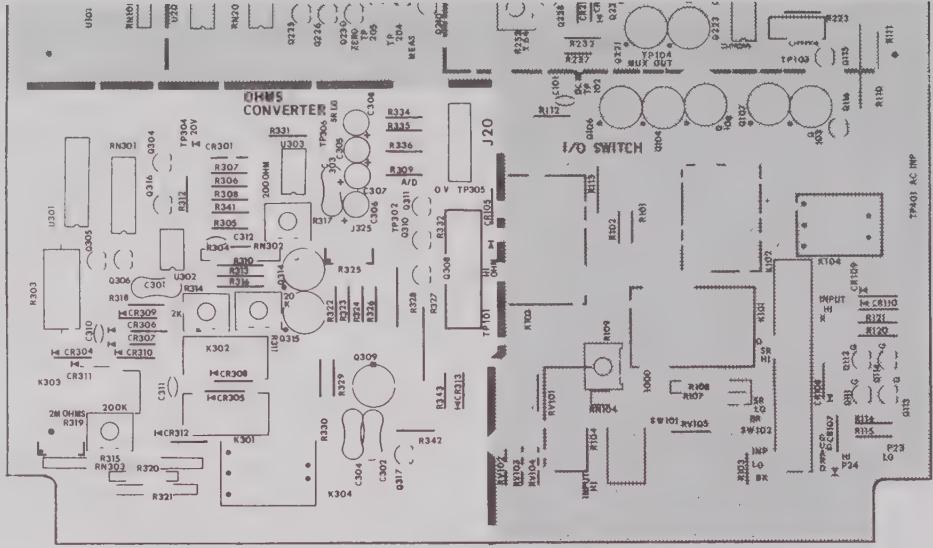


Figure 8-8. Ohms Converter

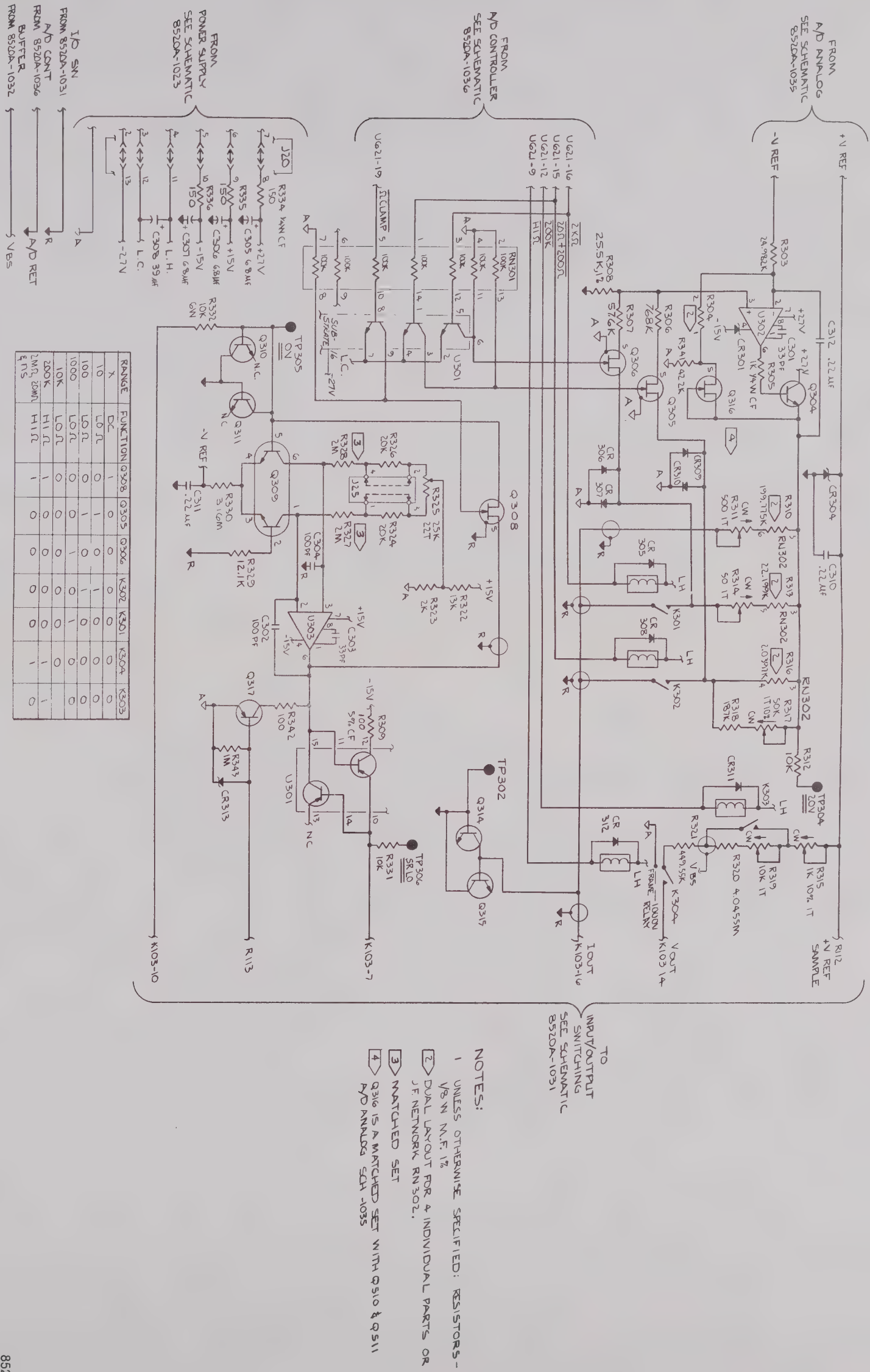
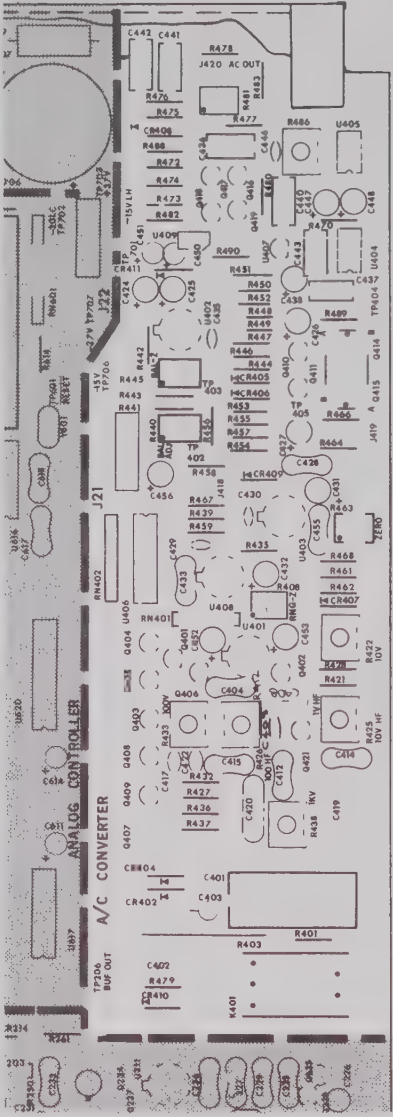


Figure 8-8. Ohms Converter (cont)

8520A-1033



Part of  
8520A-1630

Figure 8-9. AC Converter

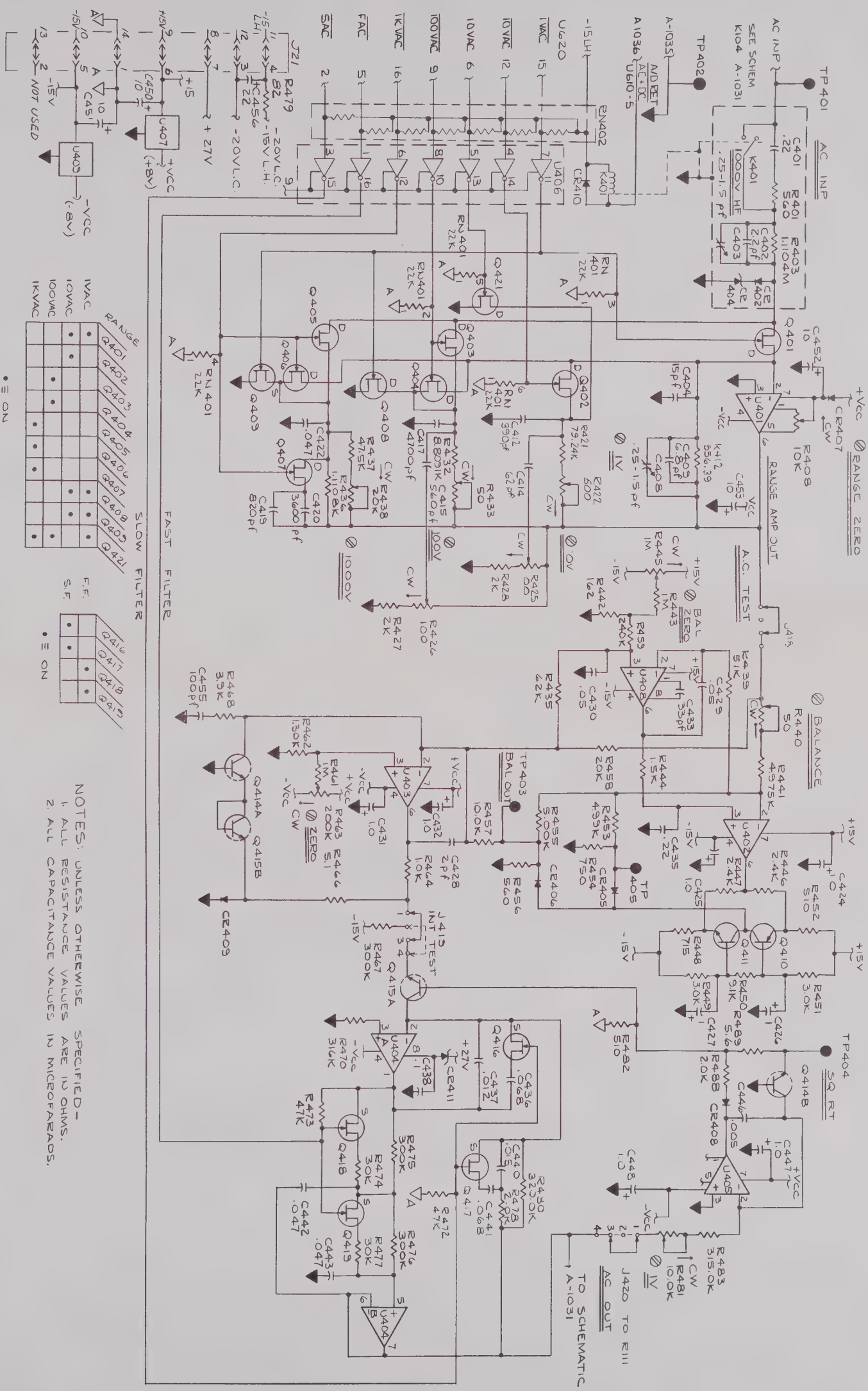


**Figure 8-9. AC Converter (cont)**

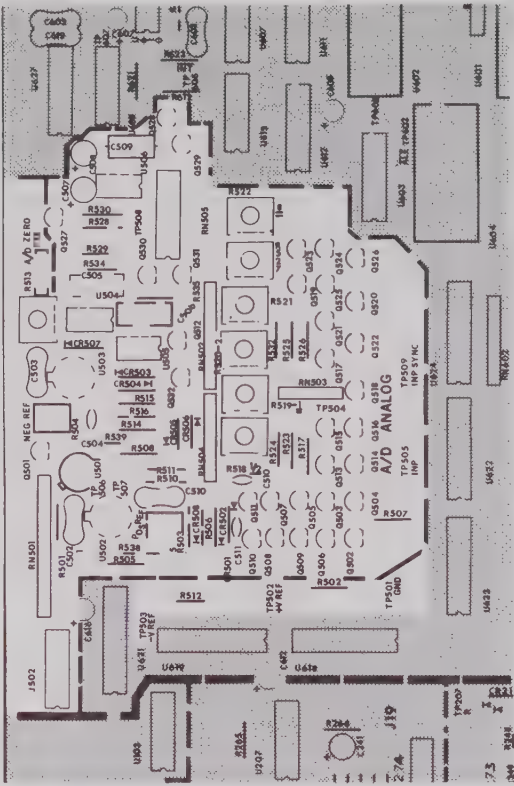


Figure 8-10. A/D Analog

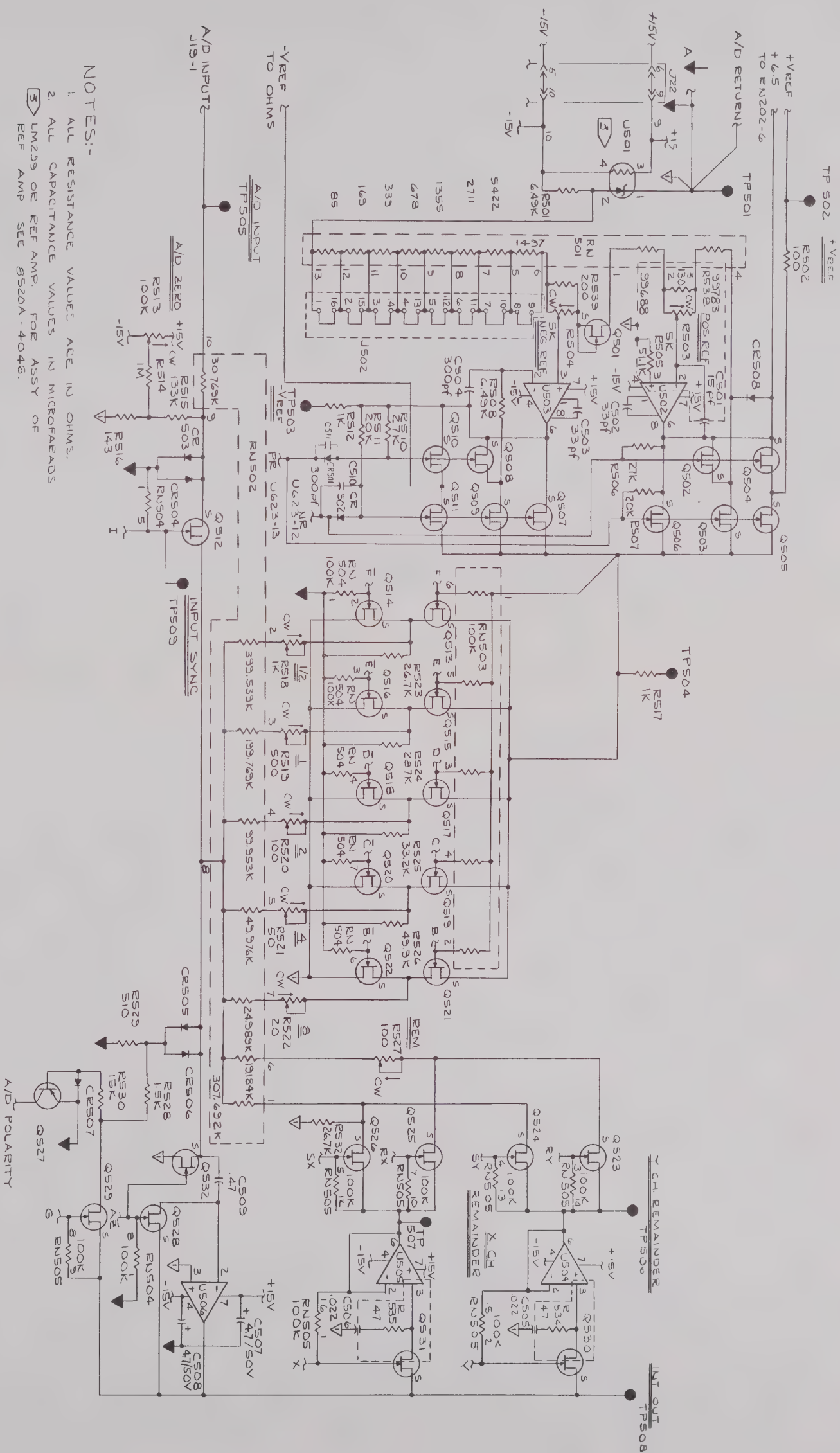
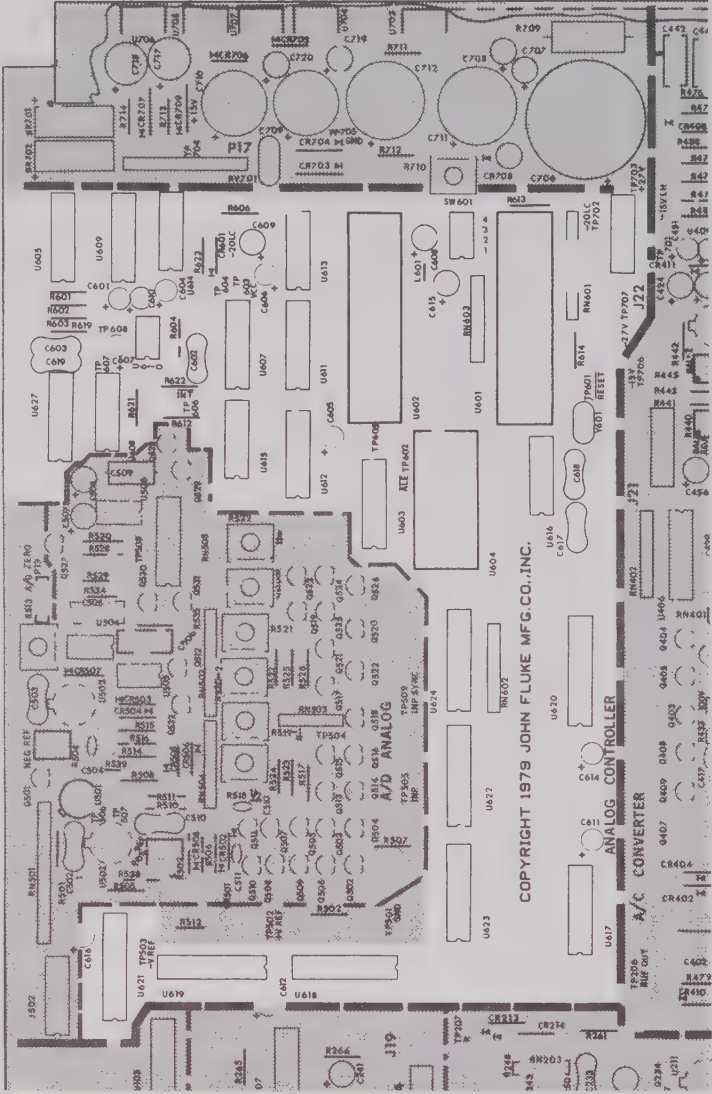


Figure 8-10. A/D Analog (cont)

8520A-1035



Part of  
8520A-1630

Figure 8-11. Analog Controller

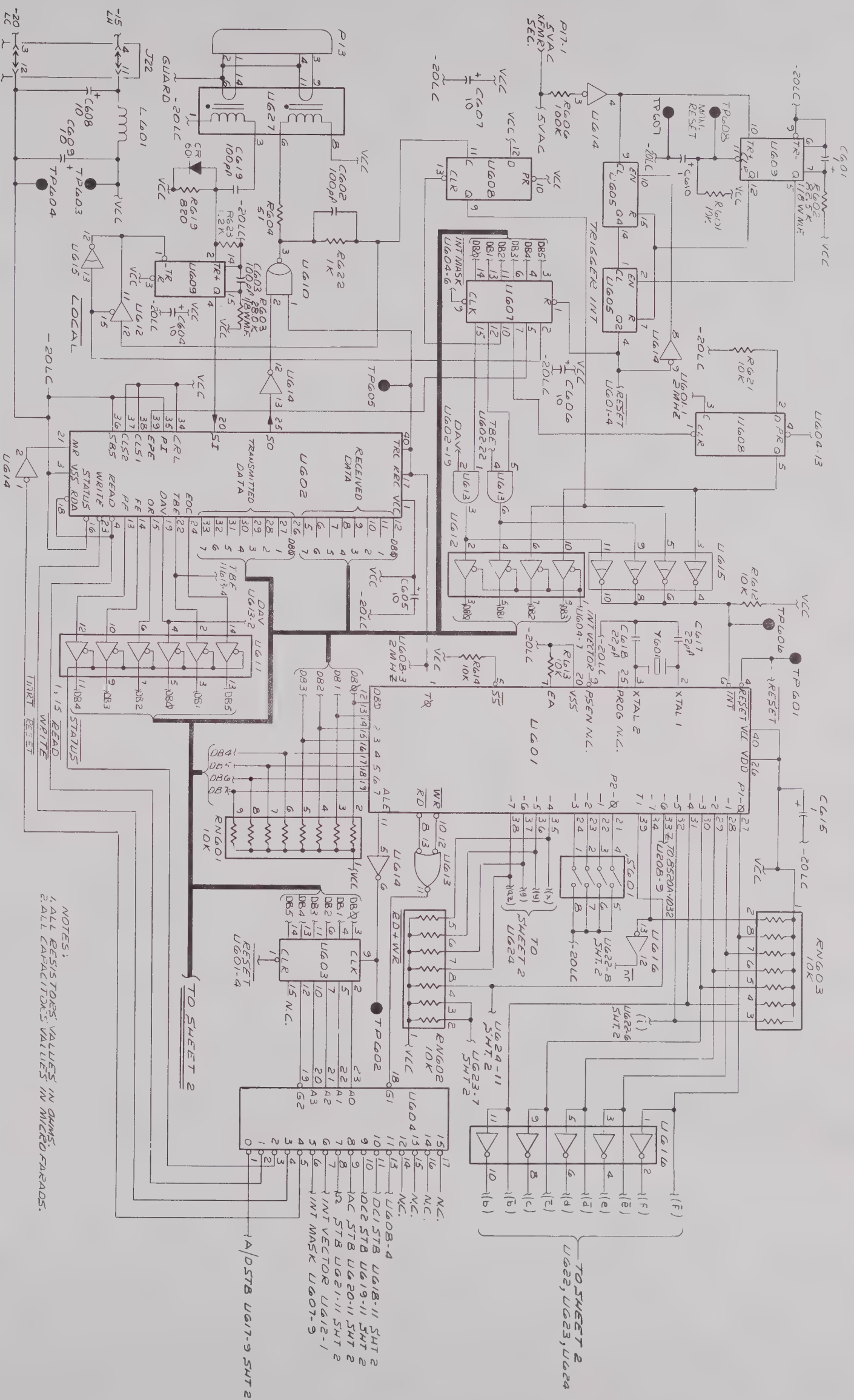


**Figure 8-11. Analog Controller (cont)**



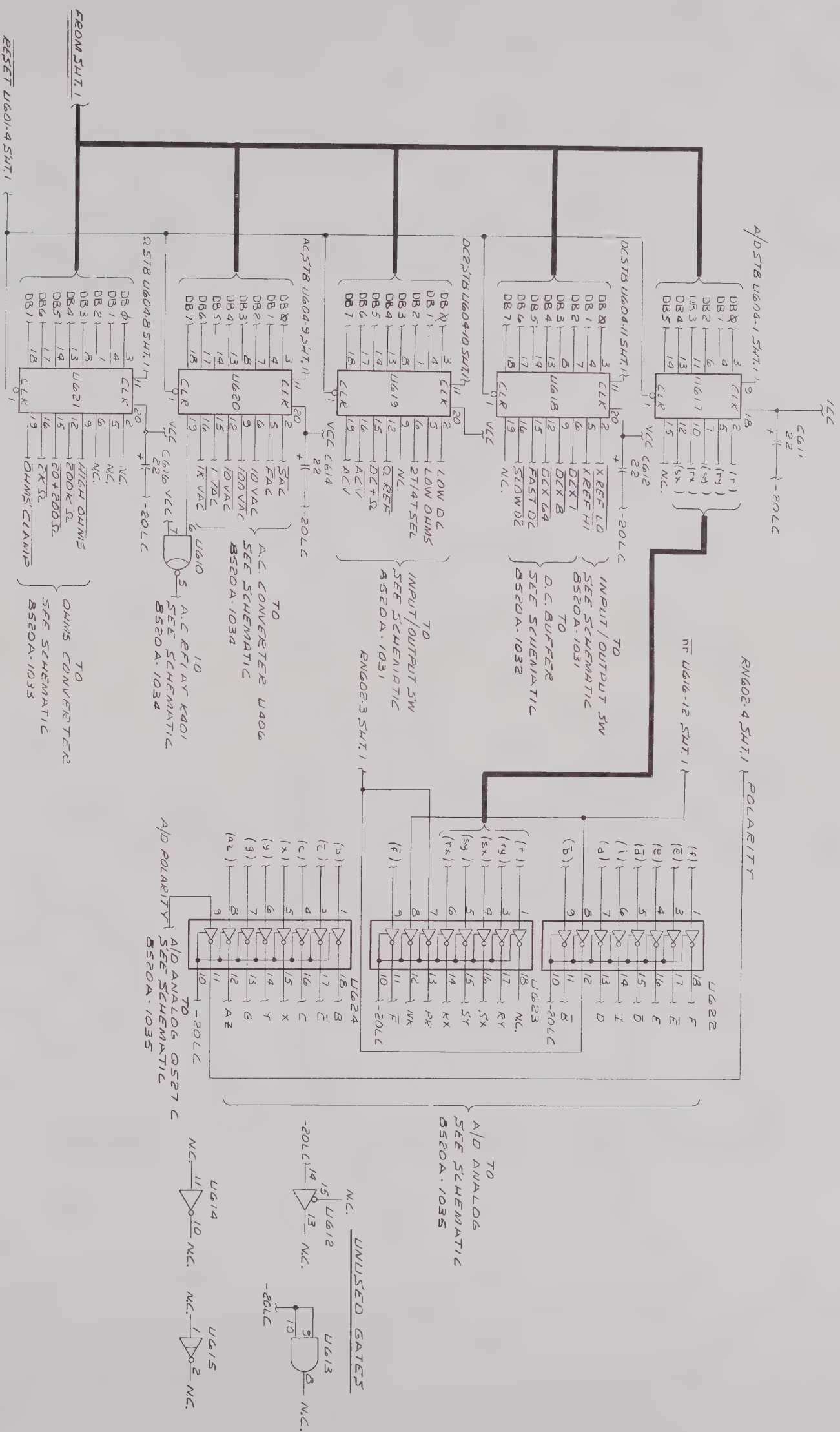
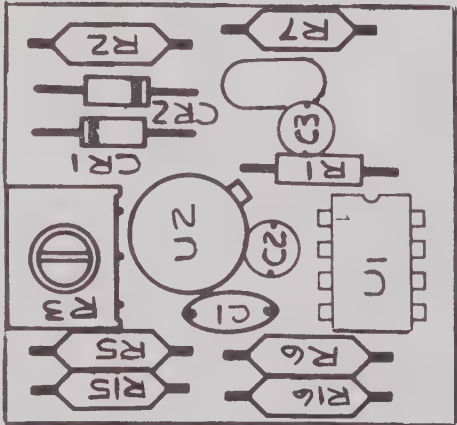
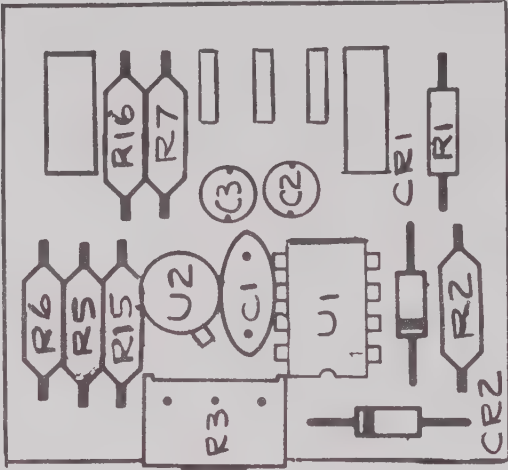


**Figure 8-11. Analog Controller (cont)**



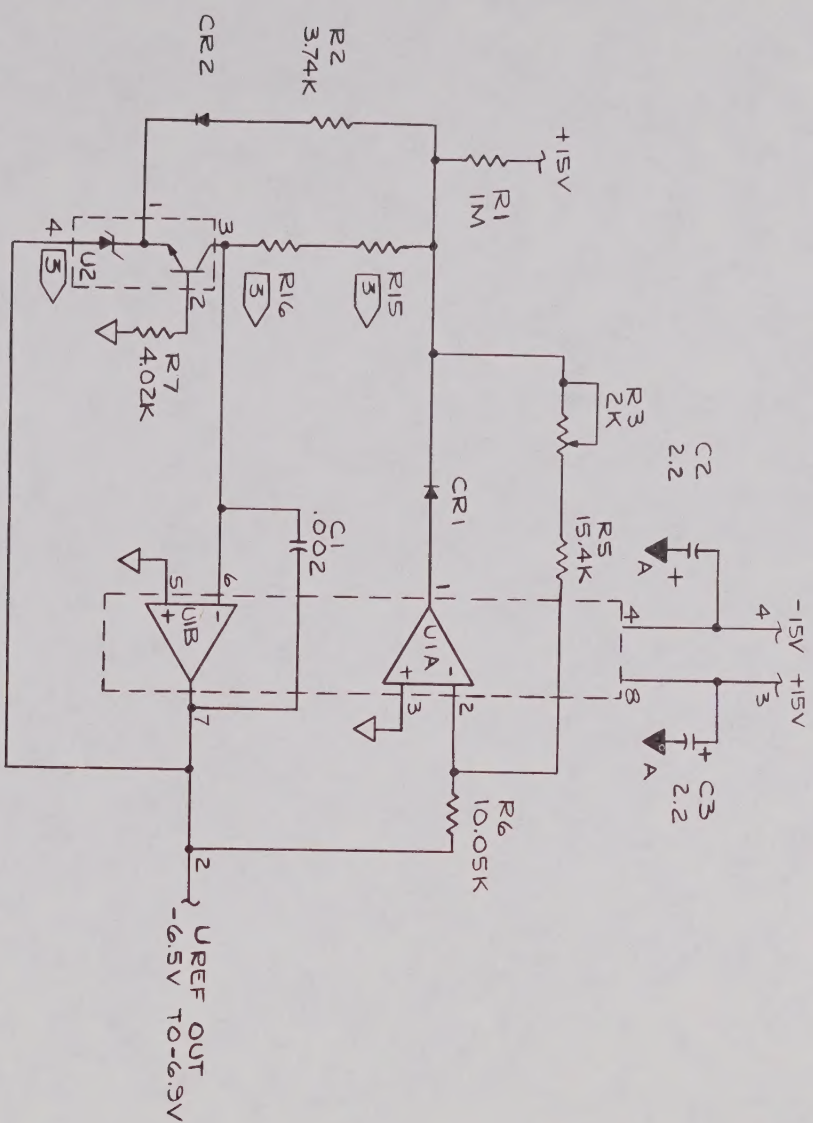
HORIZONTAL

8520A-1645



VERTICAL

8520A-1646



NOTES:-

- 1. ALL RESISTANCE VALUES ARE IN OHMS.
- 2. ALL CAPACITANCE VALUES IN MICROFARADS.
- 3. MATCHED SET JF P/N 523407 (8520A-4512).

Figure 8-12. Reference Module (cont)





[www.manualsplus.com](http://www.manualsplus.com)



1020649